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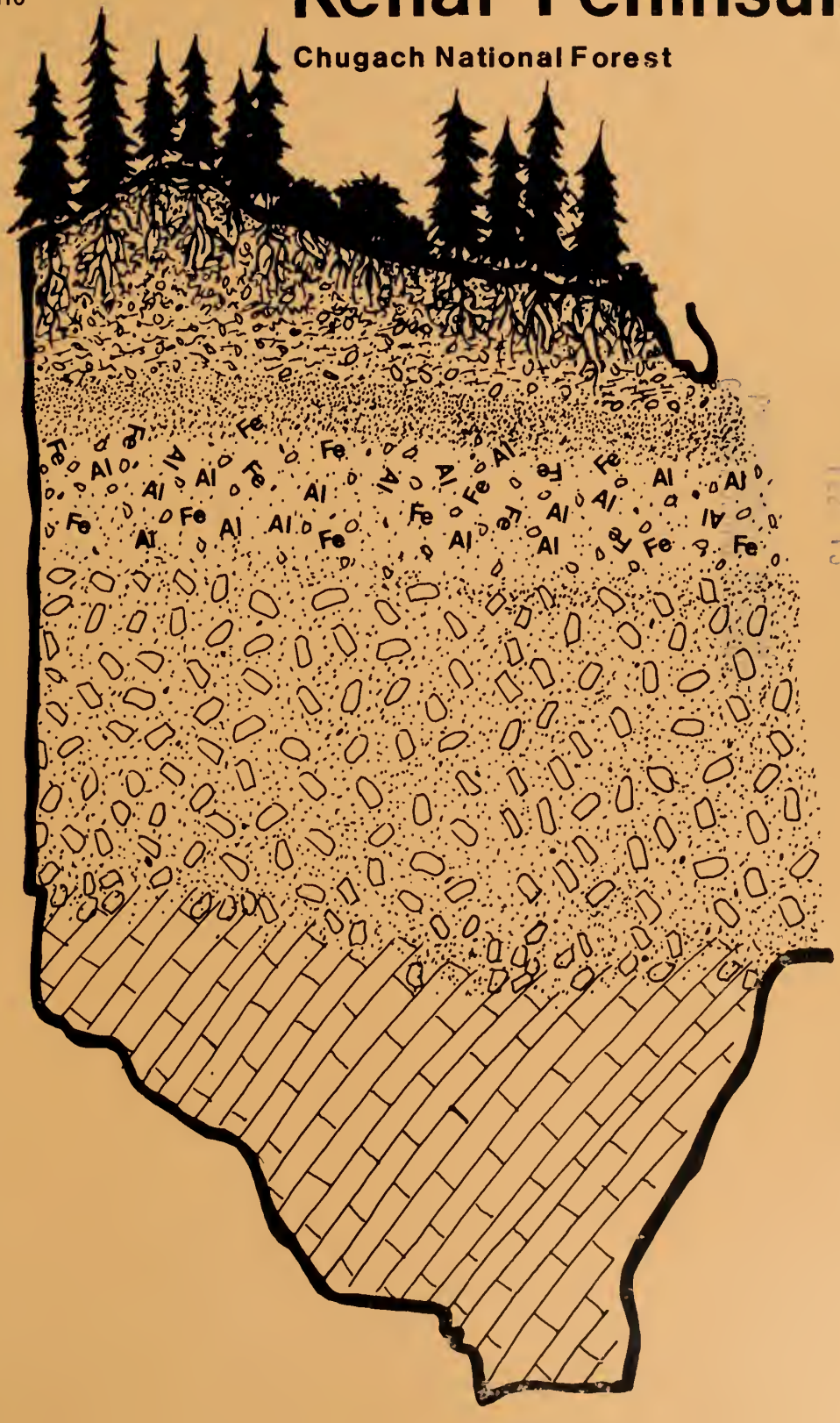
Soil Resource Inventory of the Kenai Peninsula

Chugach National Forest



Soil Resource Inventory of the Kenai Peninsula

Chugach National Forest

Alaska

1980

by

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INTRODUCTION

Location

This survey includes most of the Chugach National Forest managed land located on the northeast one-third of the Kenai Peninsula. The Kenai Peninsula is located in South-Central Alaska bounded with the Cook Inlet on the west side and Prince William Sound on the east side (Figure 1). The area is approximately 497,293 ha (1,243,233 ac) and ranges from sea level to 1970 m (6500 ft) in elevation.

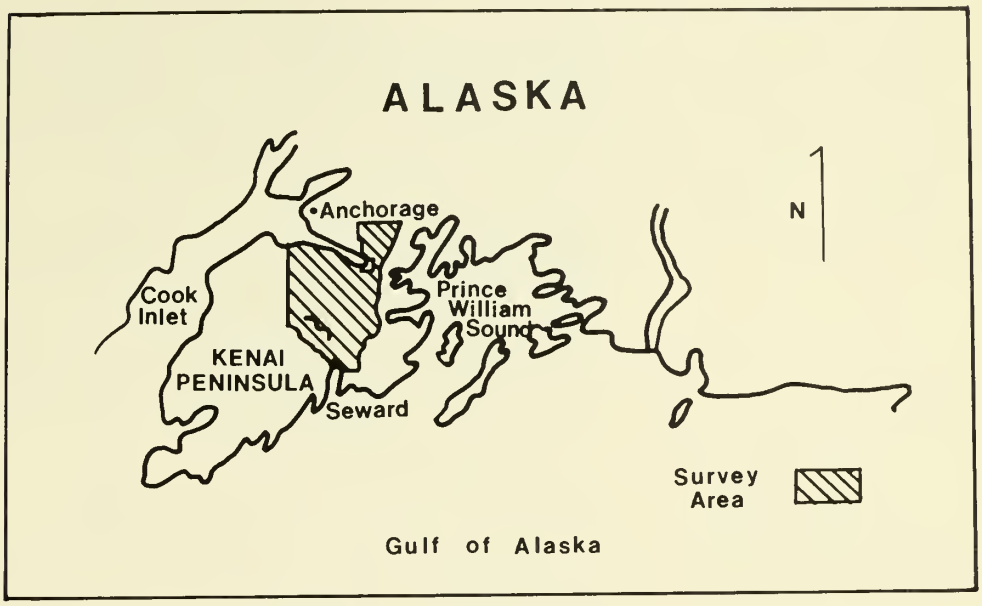


Figure 1. Index map showing the Kenai Peninsula Inventory area.

Preface

This document is divided into four major sections; the introduction material, the landtype association and landtype description section, the inventory data appendices and the landtype association and landtype maps. The introduction material is presented to give the reader a general overview on how the soils, climate and geology relate to one another on the Kenai Peninsula. The introduction also tells the reader how the inventory was mapped, the landsystem hierarchy and how to use this report.

The landtype association and landtype description section contains a picture of each mapping unit, and gives a written description of the unit including the soils and vegetation. An overview of the management considerations for each unit and a section for you, the user, to make notes are provided. The inventory data appendices present tables with the data and interpretations that were made for each soil described, and a detailed description of each soil profile. The maps show the location and general boundaries of each landtype and landtype association.

The authors ask that each user read the introduction and become familiar with the content of the report and USE it. This is designed to be a working tool and only you can make it such. Please contact your soil scientist if you require assistance.

Purpose

The purpose of the Soil Resource Inventory is to provide an information base on landform, soils, water and vegetation relationships for use in resource management and activity planning. The land system inventory used in this report provides an information base from which the land manager can make technically sound and defensible land management decisions for definitive and manageable units of land.

Application

This report is designed initially for use at the district and land management planning level. It is a working tool to help the land manager make management decisions about specific areas of land. It should be used as a tool by the land manager to better determine the need for a specialist to help him in making decisions. Other uses of the report are for broad resource and activity planning, such as transportation, recreation, wildlife, and timber management planning.

This is a reconnaissance survey. It should not be used for specific project planning, except in a very general way. As an example, this report should not be used to determine the suitability of a particular site for a campground, building site, or recreation area. It may be used to direct the planner to select areas which may have greater potential for a specific use and more detailed study. Areas such as these require information beyond the scope of this survey. Following are some suggestions for the best use of this report:

1. Read and study the report thoroughly. Get help if any part of the report is not clear or is not understood.

2. Check the report in the field. Become familiar with the landtypes and landtype associations and the soils that are described. Call attention to any apparent errors in mapping. Add your own comments and observations about how the various landtypes perform under certain management practices. The management evaluation section in the landtype description is provided for this use.

3. Utilize the information presented in this inventory for land use planning.

4. With help from Hydrology and Soils personnel, develop interpretive maps for erosion and stability hazards for use in transportation, recreation, wildlife, and timber management plans. Develop other interpretive maps as needed.

5. Use the report for broad resource and activity planning as procedures are developed.

6. Use the report as a basic document for continuing a training program of District and Forest personnel.

7. Make additions or corrections as new data become available.

The Land System Inventory

The Landsystem Inventory is a method by which a large area of land may be subdivided into relatively homogeneous divisions at different categorical levels of a hierarchy. Within the system these levels can be subdivided into smaller and more homogeneous divisions depending upon the intended multipurpose use.

The Landsystem inventory procedure was developed to provide data on landform, soils and vegetation which could be collected for a large land area in a relatively short period of time. This system provides for the identification and interpolation of inventory data on a

permanent geographical base. This information can then be used for forest land use planning and allocation as well as project level planning depending upon the level of detail of the inventory.

The most general level of division is ideally determined for the entire forest by selecting logical boundaries dependent on the relatively similar features of each natural environment. These features are based on geography, climate, lithology and vegetation. Once the most general division is determined, smaller subdivisions of more homogeneous units can be described. The order of hierarchy starting at the broadest level is Physiographic Province, Section, Subsection, Landtype Association, Landtype and Landtype Phase (4). The Landtype Association and Landtype levels are the most suitable for Land Use or Allocation Planning. The more homogeneous the level of inventory, the more detail that is included in the description of the individual landforms, soils, vegetation, and ecological association. A summary of the landsystems hierarchy as it is used on the Chugach National Forest can be seen in Figure 2.

PHYSIOGRAPHIC HIERARCHY	CHUGACH NATIONAL FOREST
Physiographic Province	Pacific Border Ranges
Province Subdivision	Kenai-Chugach Mountains
Section	Kenai Lowlands Resurrection-Six Mile Kenai Remnant Glaciers Major Glaciers
Subsection	Not identified on Kenai
Landtype Associations	Glacial Sideslopes (3)
Landtype	32
Landtype Phase	Soils and Soil Complexes

Figure 2. The Landsystem Hierarchy on the Kenai Peninsula

The Physiographic Province of the Chugach National Forest is the Pacific Border Ranges of the North American Cordillera. The subdivision of interest in this inventory is Kenai-Chugach Mountains of the Pacific Border Ranges (3). The land area of the Kenai Mountains within the Chugach National Forest boundaries has been further subdivided into the following four sections: Kenai Lowland, Resurrection/Six Mile, Kenai Remnant Glaciers, and Major Glaciers and Ice Fields (Figure 3).

Sections are defined by the topographic expression as influenced by geology, climate and time. The division of the Physiographic Province into sections is an attempt on a very generalized scale to divide the forest into areas of similar expression to better relate the land forming processes. This, plus other information, can be used in the management activities on the forest.

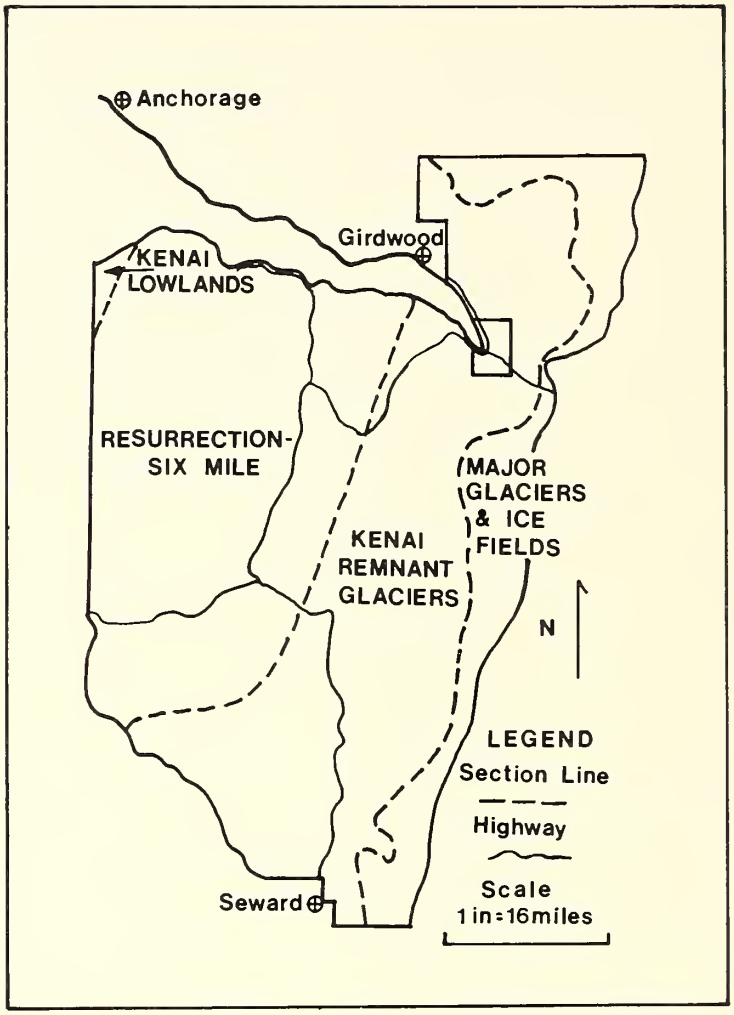


Figure 3. Map of the Kenai Peninsula area showing the location of the Sections

The sections are frequently subdivided into subsections which are defined by climate and a rocktype. The subsections are commonly used to more specifically identify hazards and potentials which relate to a specific type of bedrock. The Kenai Peninsula consists mostly of similar rocktypes so no subsections were delineated.

Sub-sections can be further divided into Landtype Associations. This level of delineation best expresses the geomorphic (land forming) processes which have most significantly influenced the landscape. An example of a Landtype Association is Glacial Sideslopes. The sideslopes have been scoured to bedrock by glaciers and subsequently covered by a layer of semi-compacted (well-fitted) till. Presently, erosion is cutting parallel V-notches through the till and depositing the material in alluvial/colluvial fans at the bottom of the slopes. Landtype Associations are the most general land delineation that is used for forest land use planning.

A better unit of delineation to be used for land use planning is the Landtype because it describes the landform in more detail. The Landtype is a more homogeneous unit which actually delineates a type of land which is an expression of climate, geology, topography and vegetation. An example of a Landtype, taken from above, is a colluvial fan. It is a depositional fan shaped landform most commonly located at the bottom of V-notched drainage channels on steep sideslopes. Its vegetation, soils, hydrologic and engineering properties are relatively similar from one colluvial fan to another.

Mapping Procedure

The Landsystem procedure starts by pre-mapping the survey area on photos into separate mapping units while in the office. Then, data is collected for each representative Landtype, and the boundaries are checked in the field to increase the accuracy of the premapping. The USGS topographical maps or aerial photographs are used for the premapping and for recording the location of the field checks. The scale of the photo or map depends on the level of detail of the inventory. The more time available for data collection, the greater the number of samples that can be collected for each mapping unit. This data is then correlated and extrapolated to all mapping units throughout the forest that are represented by the one sampled in the field.

Interpretation and management practices can then be determined for all of the different homogeneous mapping units of the forest without having to visit each one in the field. As the necessity for more detail planning or use arises, more mapping units will be visited and more data collected.

GENERAL DESCRIPTION OF THE DEVELOPMENTAL PROCESSES

Geology

The geology of the Kenai is dominated by major uplifting and mountain building starting in the late Cretaceous Period, and by more recent periods of mountain and valley shaping by glaciation (5). Major structural faulting by the Border Ranges fault and the Eagle River fault on the west side of the mountains have resulted in uplifted mountains relative to the Kenai Lowlands. The upthrusted Placer River fault running north-south through the center of the Peninsula appears to be partially responsible for the Twenty Mile and Placer River drainages and the higher mountains on the east side of the Peninsula.

The rocks that are found on the Kenai Peninsula are mostly of sedimentary origin resulting from deposition in a geosyncline early in the Cretaceous period. Since there was a relatively short geologic time period between the depositional cycle and the uplift cycle of the Kenai Mountains, there was not a lot of time available for metamorphism or consolidation of the sediments to produce competent rocks. Hence, most of the rocks on the Peninsula are highly fractured and susceptible to weathering and erosion. The majority of the rocks on the Peninsula are graywacke, slate, argillite, conglomerate, volcanic detritus and mafic (dark colored) volcanic rocks. The west side of the mountains are made up of greenstone, limestone, chert, granodiorite and schist.

The most obvious physiographic features on the Kenai Peninsula are the steep sided, U-shaped valleys, the deep outwash deposits and hummocky high valley bottoms left by the receding glaciers. Most of the extensive glaciation occurred within the last 100,000 years(1). Some major and many minor glacial cycles occurred during this period producing glaciers which are thought to have been over 900 m (3000 ft) thick(2). Physiographic evidence indicates that glaciation on the west side of the Kenai Mountains was somewhat less intense than the east side. The lower mountains and drier climate on the west side and the higher mountains, wetter climate and presence of large glaciers on the east side seem to verify this. As an example, the Resurrection Creek drainage shows thick accumulations of outwash (alluvial) deposits from the melt water of receding glaciers up valley and higher tributary drainages. These deposits are easily eroded and are deeply incised by Resurrection Creek. The sideslopes which originally were scoured by the glaciers now show greater effects from water eroding deep V-notched parallel drainages. Further eastward the land features place more emphasis on glaciation and less on water erosion. The Placer River stands out as an example of an active glacial valley with steep, recently glaciated sideslopes, an active sediment laden river, an outwash plain in the valley bottom and an active glacier at the head of the valley. Farther east, the landscape consists mainly of an ice field dotted with a few mountain tops.

Climate

The climate on the Kenai Peninsula is complex in that it includes three major types; maritime, transitional and continental. Much of the variety is the result of a dominant storm track from the south and southeast and a minor storm track from the west. In both cases the coastal shoreline and mountains receive the greater amounts of precipitation which generally decreases toward the northwest corner. The western storms lose much of their precipitation in the Alaska

Mountain Range on the west side of the Cook Inlet. The coastal mountains in effect produce a shadow for the less intense areas. The records show Seward to have a mean annual precipitation of 160 cm (63 in), and Whittier with about 444.5 cm (175 in), which decreases rapidly to Moose Pass with about 63.5 cm (25 in) and Cooper Landing with about 50.8 cm (20 in). The months of September and October generally have the heaviest amounts of precipitation, although the coastal areas receive significant amounts of precipitation throughout the year(10).

Air temperature is influenced strongly by the moderating effects of the coastal areas are relatively cool in the summer and warm in the winter. Comparisons can be made between Seward and Anchorage. Seward has a mean annual July temperature of 12.8°C (55°F), whereas Anchorage has 14.5°C (58°F). Seward also has a mean annual January temperature of about -3.9°C (25°F) and Anchorage has about -11.1°C (12°F).

The amount of precipitation that falls as snow is dependent upon the air temperature. Generally, greater amounts of snow accumulate with increasing elevations. The heavier precipitation in the eastern and southern coastal mountains produces over 1016 cm (400 in) of snow annually. The total snowfall decreases toward the northwest to about 177.8 cm (70 in) because of the shadow effect produced by the coastal mountains.

Soil Development

Soils are the result of five major factors; parent material, topography, climate, biological activity and time for development. To varying degrees, each of these factors play a role in the development of soils regardless of where they are found. The two most important factors that affect soil development on the Kenai Peninsula are climate and topography. The soils on the Kenai Peninsula started their development as recent as 5-10,000 years ago. Before this time, most of the Peninsula was covered by glaciers. These glaciers carved the topography to produce high, jagged alpine mountains with steep slopes, U-shaped valleys and glacial outwash plains. On these three major topographic situations, the soils have developed relative to the above factors.

The high alpine areas are dominantly influenced by ice and frost which expands in the cracks of the rocks and breaks them into smaller fragments. Eventually these either roll down the steep hillsides or if small enough, they are blown away by the wind or washed down the hillside by water. The parent material appears to have relatively little affect on the soils because of the dominate influence of the glaciers and erosion to pickup, transport, and deposit the soil material in an unlimited variety of combinations. In many places the wind has redeposited soil or transported and deposited a layer of volcanic ash. The cold temperatures have restricted much of the chemical weathering and biological activity that would normally occur in warmer climates. This, in combination with the short time span since glaciation, has greatly restricted soil development and productivity.

The soils found on the steep upper sideslopes will generally be shallower near the top and increase in depth downslope. This is due to the decreasing affects of erosion from frost, wind and water lower on the slopes. In areas that are not protected from erosion, the soils are poorly to moderately developed with much of the soil being eroded away before any development can take place. These areas are

commonly dissected by V-notches with most of the soils being well drained.

The lower concave sideslopes, because they have less slope gradient, receive much of the soil material eroded from the steep upper slopes. These areas may be thought of as a transitional area between the erosional processes of the upper sideslopes and the depositional processes in the valleys. Some soils in this area have developed in glacial till and may be distinguished by a medium textured soil with non sorted rocks and gravel in the upper profile and a somewhat compacted water restricting layer in the lower profile. The existence of water restricting layer is often discernable by the presence of water tolerant vegetation. Soils of the lower sideslope area are usually moderately deep to deep and in many places the finer textured soils will be poorly drained and/or saturated with high amounts of runoff from the slopes. A special case of the lower sideslope soils are those at the bottom of the V-notches. These generally consist of more rock fragments relative to the somewhat finer textured soils at the base of flat slopes.

The soils in the valley bottoms have developed in the depositional material left by receding glaciers or by rivers and streams. Inclusions of bedrock are found in some locations. Soils that have developed in alluvial and outwash material are characterized by a deep fine to coarse sandy matrix with well sorted gravels and cobbles. Most of these soils are well drained. There are select locations of fine textured soils that have originated from water transported sediment that was deposited in pools, protected areas along the stream edge or in off-lying areas during periods of flooding. These soils impede water drainage. There are some places on the Peninsula where alluvial soils occur that are not necessarily confined by valley sideslopes. These wider valleys have active glaciers in the upper end and the larger rivers on the Peninsula. These soils are deep and range in characteristic from entirely rounded gravels and cobbles to fine sands and silts. Soil drainage ranges from poorly drained to excessively drained.

LANDYTPE ASSOCIATION
and LANDTYPE DESCRIPTIONS

Explanation of Mapping Units

This inventory contains mapping units on a general level, the Landtype Association, and on a more specific level, the Landtype. The landtype associations were mapped in the high mountainous areas where use is less intensive, and the landtypes were mapped in the valleys occupied by recreational developments and road corridors where use is more intensive.

The following descriptions summarize the general characteristics of the mapping units on the Kenai Peninsula. They include a topographic description of the unit, a brief description of the major soils and vegetative types that are in each unit, and the major factors to be considered in management of the unit. A more detailed description of the soils in each unit can be found in Appendix D.

The relationship of one mapping unit to another is important in the evaluation of an area for management planning and activities. The general relationships of the mapping units on the Kenai Peninsula to each other can be understood by viewing their position on the landscape.

The major valleys of the Kenai Mountains are U-shaped in cross section due to being glacially carved. The higher elevations above and between the valleys are characterized by the Alpine (AH) and Frost Churned (FCH) Highlands which have a thin mantle of alpine soil and exposed fractured rocks. The glacial valley sideslopes (GS) are divided into upper and lower according to their slope and erosional or depositional nature, and divided into forested and non-forested largely due to exposure. Soils on the upper sideslopes (31 and 32) are generally shallow and associated with deeply incised V-shaped drainages. Soils of the lower sideslopes (33 and 34) are generally accumulations of soil and rock eroded from the slopes above over deposits of compacted till. Finer textured windblown deposits also compose part of the soil surface. A special case of the lower sideslopes is a Scree Fan (35), which generally has a deeper coarser textured soil.

Glacial valley bottoms are composed of a broad spectrum of landtypes which are depositional in nature as effected by the glacial and alluvial history of the site. The high and low relief glacial moraines (71 and 72) generally have deep non-sorted soils of glacial till. Outwash plains (71 and 89) also have deep soils of glacial till but these are water deposited and weakly sorted. Valley bottom soils which are alluvial in origin make up alluvial terraces (88), alluvial fans (81), low-lying flood plains (82) and unvegetated stream channels (83). These soils are generally deep, and have been sorted and stratified to varying degrees while being deposited by water. A special case and relationship of the valley bottom soils is the alluvium and till bench (87) above the river-cut sideslopes into alluvium and till (84) or bedrock (85). These soils are deep except

where the river cuts into bedrock, and they range from compact glacial till to water sorted and stratified material. Narrow valleys at higher elevations generally have valley train deposits (86) of moderately sorted and reworked material, till and alluvium.

Lands which have been extensively scoured by glacial ice (ISL) have been divided into forested (102) and non-forested (101) based mostly on the depth of soil. These soils are mostly glacial till with some depression muskegs.

The sideslopes of non-glaciated valleys and/or those glaical sideslopes that are being rejuvinated by active gully erosion are characterized by breaklands (BL). The streams at the base of these slopes are downcutting faster than the upper surfaces can retreat forming V-shaped drainages, and providing a continuous source of rock fragments to the stream channels below. The breaklands (BL) are divided into early (111), mid (112) and late (113) stage according to the development of these erosional features. As the cycle matures the erosion pattern evolves from widely spaced, rounded and shallow V-notches which form a parallel drainage pattern and carry water only during the highest flows, to closely spaced, sharp and deep V-notches which form a dendritic drainage pattern and carry water during most of the year. Another form of breaklands occurs in areas at the head of valleys and/or in bowl-like topography. These headlands (114) have similar erosional features but the parallel and/or dendritic drainage patterns converge at the bottom of the landform. The stages of the erosional cycle in the headlands are not identified.

ALPINE HIGHLAND LANDTYPE ASSOCIATION

Map Symbol: AH

Association Description:

The Alpine Highland landtype association is common to both the Resurrection/Six Mile and the Kenai Remnant Glacier sections of the Chugach National Forest. This association has not been mapped into its component landtypes on the Kenai Peninsula.

The Alpine Highlands include all the jagged rocky ridges and peaks along with their associated sideslopes and cirque headwalls at the ends of glaciated valleys, rock basins and rock glaciers. Glaciation, frost and the severe climate are the major forces of erosion on this landtype association. The results of these forces are the presence of many loose rock fragments along with V-shaped drainages deeply incised into the exposed and highly fractured bedrock. The fine textured materials are transported by wind and the rock fragments by gravity.

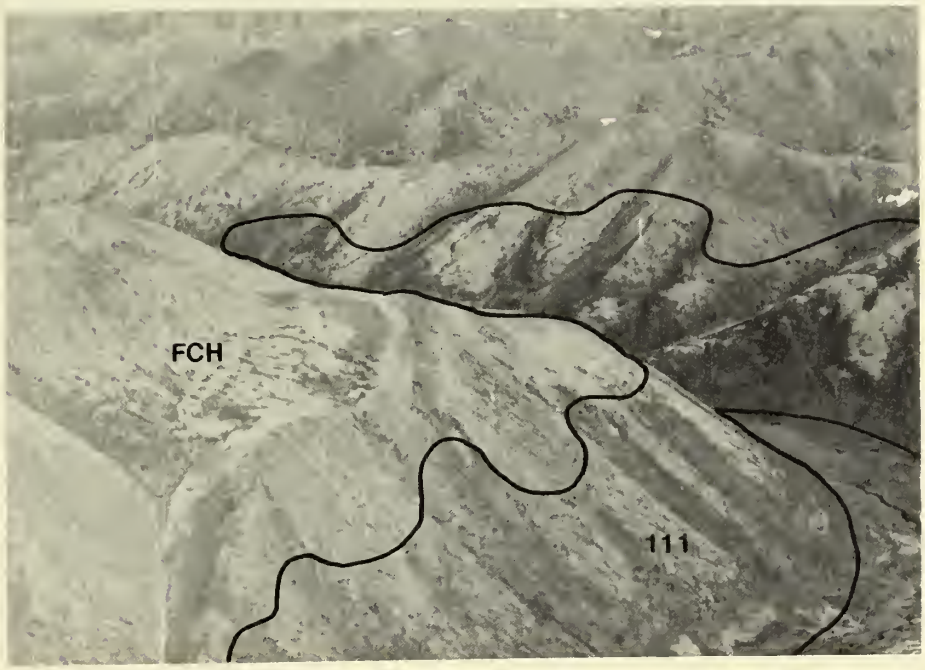
The Alpine Highland landtype association is found on the Kenai Peninsula at elevations generally above 910 m (3000 ft). Slope gradients are extremely steep (greater than 75 percent) throughout most of the assocation except in the bottom of cirque basins and along rock glaciers where accumulation of rock debris and fine material has occurred.

Soils and Vegetation: Approximately 90 percent of the Alpine Highland landtype association includes rock ledges and cirque headwalls which are not vegetated. The remaining approximate 10 percent of the association which includes cirque basins and rock glaciers has a thin mantle of alpine vegetation consisting of grasses, sedges, alpine bearberry, crowberry, reindeer moss, with other lichens and mosses. The soils of this area which are represented by soil number 1 are deep and well drained. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a loam to fine sandy loam texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles. The gravel and cobbles are angular.

Management Considerations: The Alpine Higlands Association has severe restrictions for most management activities due to extremely steep slopes, high altitudes, a high avalanche hazard and the large amount of rock at the surface.

FROST CHURNED HIGHLAND LANDTYPE ASSOCATION

Map Symbol: FCH



Association Description:

The Frost Churned Highland landtype association is common to both the Resurrection/Six Mile and Kenai Remnant Glacier sections of the Chugach National Forest. This association has not been mapped into its component landtypes on the Kenai Peninsula.

The Frost Churned Highlands include the rounded ridge tops and smooth upper sideslopes which have not been glaciated, but have been strongly influenced by the frost. Frost has expanded in the cracks of the exposed bedrock and fractured it so most of the ground is covered by a deep layer of loose rock fragments. Few surface drainage channels exist due to the high rates of infiltration and permeability of the rock fragments. In some areas, the frost has pushed up the soil to form small frost heave mounds up to nearly 60 cm (2 ft) in height.

The Frost Churned Highland landtype association is found on the Kenai Peninsula generally at elevations ranging from 910 to 1270 m (3,000 to 4,200 ft). Slope gradients are moderately steep to steep (20 to 50 percent).

Soils and Vegetation:

Approximately 75 percent of the Frost Churned Highland landtype association has an alpine vegetative cover which consists of alpine bearberry, lowbush cranberry, crowberry, bunchberry, reindeer moss, with other lichens and mosses. The soils of this area which are

represented by soil number 2 are deep and well drained. The surface soil has a loam texture with about 20 percent gravel and about 20 percent cobbles. The subsoil has a sandy loam texture with 20 to 35 percent gravel and 30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles. The gravel and cobbles are angular.

The remaining 25 percent of this association consists of exposed talus and bedrock outcrops with minimal soil and vegetative cover.

Management Considerations:

The Frost Churned Highland landtype association has severe limitations for most management activities due to steep slopes, high altitudes and areas of exposed talus and bedrock outcrops scattered throughout the landtype.

GLACIAL SIDESLOPE LANDTYPE ASSOCIATION

Map Symbol: GS

Association Description:

The Glacial Sideslope landtype association is common to both the Resurrection/Six Mile and Kenai Remnant Glacier sections of the Chugach National Forest. Much of this association has been mapped into its component landtypes for the high use areas of the Kenai Peninsula.

The glacial sideslopes include the relatively uniform sides of U-shaped, glacially carved valleys. These slopes can be recognized by the steep (21 to 65 percent), flat upper sideslopes grading into concave lower sideslopes. Soil and rock are eroded from the upper slopes resulting in deep, parallel V-notched drainage channels, and deposited below in colluvial fans. The density of the drainage channels on these sideslopes is dependent on slope gradient, aspect, precipitation and surface geology. Other rock material worked loose by frost rolls downslope to accumulate as talus. The vegetation ranges from grass, fireweed, geranium, ferns and alder on slopes of south to west exposure and in active snow slide paths, to a white spruce - mountain hemlock overstory and a menziesia-vaccinium understory on lower, north aspect slopes (8).

The landtypes that are included in the Glacial Sideslope landtype association are: Upper Sideslope - Forested (31); Upper Sideslope - Non-forested (32); Concave Lower Sideslope - Forested (33); Concave Lower Sideslope - Non-forested (34); and Scree Fan (35).

Upper Sideslope - Forested Landtype

Map Symbol: 31

Landtype Description:

The Forested Upper Sideslope landtype of the Glacial Sideslope landtype association includes the steep upper slopes of glacial U-shaped valleys that have a canopy cover greater than 40 percent. This landtype is usually located below the Frost Churned Highland landtype association (FCH) and above the two concave lower sideslope landtypes (33 and 34). Soil and rock eroded from this landtype are deposited on the two Concave Lower Sideslope (33 and 34) and Scree Fan (35) landtypes. Erosion has resulted in parallel deeply incised V-shaped drainages which are a common feature of this landtype.

The Forested Upper Sideslope landtype generally occurs at elevations ranging from 550 to 910 m (1800 to 3000 ft). Slope gradients are steep (40 to 70 percent) with slope lengths from about 210 to 610 m (700 to 2000 ft). These forested upper sideslopes usually have a northern exposure and/or are located where the avalanche activity is low to moderate.

Soils and Vegetation:

The soils of the Forested Upper Sideslope landtype have formed in deposits of glacial till over shale and/or graywacke bedrock. Approximately 50 percent of the landtype has a vegetative cover of mountain hemlock with rusty menziesia, blueberry, ferns and mosses. The soils of this area which are represented by soil number 3 are deep and well drained. The surface soil has a loam texture with 5 percent gravel and 20 percent cobbles. The subsoil has a sandy loam to loamy sand texture with 10 to 25 percent gravel and 10 to 20

percent cobbles. Beneath the solum the substratum has a coarse sand texture with about 30 percent gravel and about 20 percent cobbles.

Approximately 30 percent of the Forested Upper Sideslope landtype has a mountain hemlock with rusty menziesia vegetative cover similar to that described above but whose soils are not similar. The soils of this area which are represented by soil number 4 are somewhat excessively drained and shallow with bedrock within 20 to 50 cm (8 to 20 in) from the surface. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a sandy loam texture with about 20 percent gravel and 15 to 20 percent cobbles. Beneath the solum is shale and/or graywacke bedrock.

About 10 percent of the landtype has a vegetative cover of sitka alder and bluejoint grass with a variety of forbs and ferns. The soils of this area which are represented by soil number 2 are deep and moderately well drained. The surface soil has a loam texture with about 20 percent gravel and about 20 percent cobbles. The subsoil has a sandy loam texture with 20 to 35 percent gravel and 30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles.

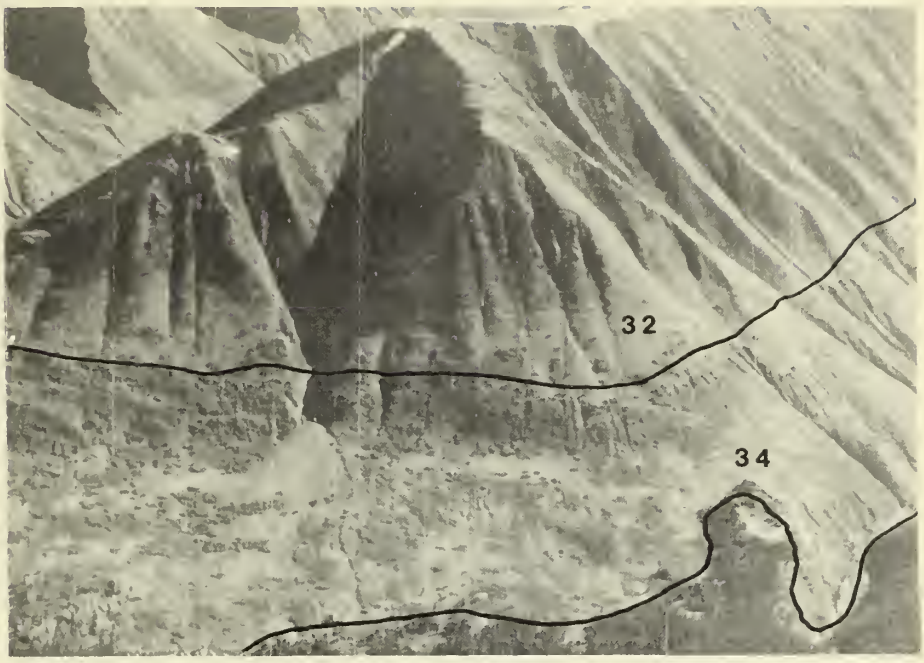
The remaining 10 percent of the Forested Upper Sideslope landtype is composed of deeply incised V-shaped drainages which have seepages over the rock and soil surfaces. The vegetative cover along the drainages is composed of alder, devil's club, ferns and grasses. The soils of this area which are represented by soil number 5 are a deep and poorly drained mat of highly decomposed organic debris over glacial till and rock. The organic surface soil is a muck which has a sapric texture with some fiber content. Beneath the surface organic soil, there is a thin layer of mineral soil which has a loam texture with about 50 percent gravel and about 5 percent cobbles. The organic subsoil is also a muck which has a sapric texture with almost no fiber content. Beneath the solum the mineral substratum has a loam to sandy loam texture with about 50 percent gravel and about 10 percent cobbles.

Management Considerations:

The Forested Upper Sideslope landtype has severe restrictions for most management activities due to steep slopes. Throughout the landtype there is a high soil creep hazard and a high to very high surface erosion hazard if the vegetative cover is removed and mineral soil is exposed by cut and fill road or trail construction. The V-notched drainages also have a high avalanche hazard and thick accumulations of organic matter on the surface.

Upper Sideslope - Non-forested Landtype

Map Symbol: 32



Landtype Description:

The Non-forested Upper Sideslope landtype of the Glacial Sideslope landtype association includes the steep upper sideslopes of glacial U-shaped valleys that have a canopy cover less than 40 percent. This landtype is generally located below the Frost Churned Highland landtype association (FCH) and above the Non-forested Concave Lower Sideslopes landtype (34). Much rock and soil are eroded by avalanche and colluvial activity from these upper sideslopes. This material is deposited on the Concave Lower Sideslope (33 and 34) and Scree Fan (35) landtypes. Erosion has resulted in parallel deeply incised V-shaped drainages which are a common feature of this landtype.

The Non-forested Upper Sideslope landtype generally occurs at elevations ranging from 550 to 910 m (1800 to 3000 ft). Slope gradients are steep (40 to 70 percent) with slope lengths from about 210 to 610 m (700 to 2000 ft). These Non-forested Upper Sideslopes usually have a southern exposure and/or are located where the avalanche activity is high.

Soils and Vegetation:

The soils of the Non-forested Upper Sideslope landtype have formed in deposits of glacial till over shale and/or graywacke bedrock. Approximately 50 percent of the landtype has a dense vegetative cover of sitka alder, ferns and grass. This vegetation is found on smooth slopes and along the edges of deeply incised V-shaped drainages. The soils of this area which are represented by soil number 1 are deep and well drained. The surface soil has a fine sandy loam texture

with about 10 percent gravel and about 5 percent cobbles. The subsoil has a loam to fine sandy texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles. The gravel and cobbles are angular.

About 20 percent of the Non-forested Upper Sideslope landtype has a thick vegetative cover of grasses, fireweed, lowbush cranberry and crowberry, with some sitka alder and willow. The soils of this area which are represented by soil number 2 are moderately deep to deep and well drained. The surface soil has a loam texture with about 20 percent gravel and about 20 percent cobbles. The subsoil has a sandy loam texture with 20 to 35 percent gravel and 30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles.

Approximately 15 percent of the landtype is located at the higher elevations immediately below the Frost Churned Highland landtype association. This area has an alpine type vegetative cover which consists of geranium, crowberry, alpine bearberry, fireweed, reindeer moss, other lichens and mosses. The soils of this area which are also represented by soil number 2 have been described above.

About 10 percent of Non-forested Upper Sideslope landtype is composed of deeply incised V-shaped drainages which have seepages over the rock and soil surfaces. The vegetative cover is composed of sitka alder, devil's club and ferns along the drainages. The soils of this area which are represented by soil number 5 are a deep and poorly drained mat of highly decomposed organic debris over glacial till and rock. The organic surface soil is a muck which has a sapric texture with some fiber content. Beneath the surface organic soil there is a thin layer of mineral soil which has a loam texture with about 50 percent gravel and about 5 percent cobbles. The organic subsoil is a muck which has a sapric texture with no fiber content. Beneath the solum the mineral substratum has a loam to sandy loam texture with about 50 percent gravel and about 10 percent cobbles.

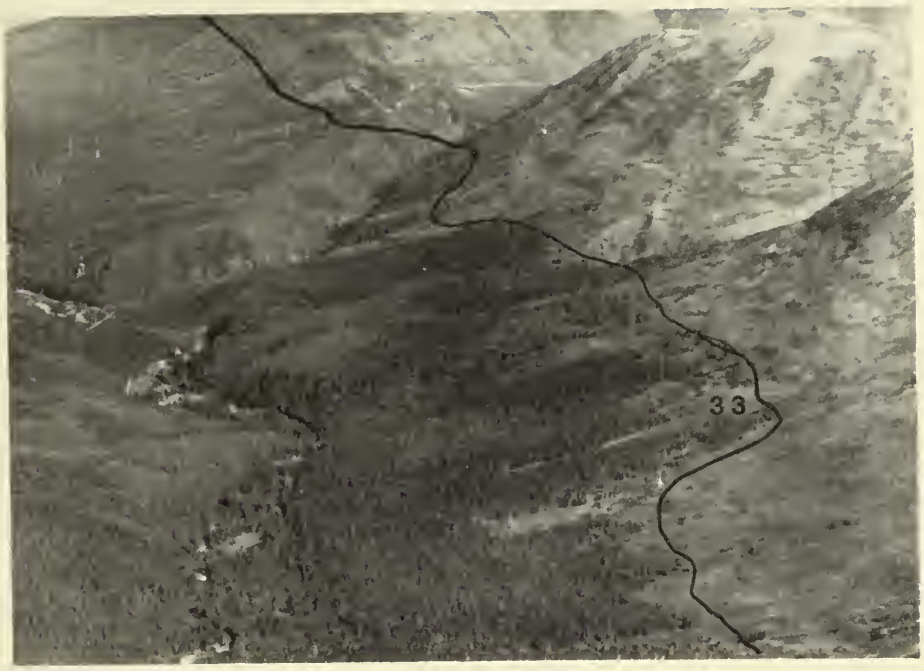
The remaining approximate 5 percent of the landtype has a dense vegetative cover of mountain hemlock with blueberry, ferns and mosses. The soils of this area which are represented by soil number 2 which have been described above.

Management Considerations:

The Non-forested Upper Sideslopes landtype has severe limitations for most management activities due to steep slopes and a high to very high avalanche hazard. There is a high surface erosion hazard if the vegetative cover is removed and mineral soil is exposed by cut and fill trail or road construction. Bedrock occurs within 100 cm (39 in) of the surface in those areas of the landtype represented by soil number 2.

Concave Lower Sideslope - Forested Landtype

Map Symbol: 33



Landtype Description:

The Forested Concave Lower Sideslope landtype of the Glacial Sideslope landtype association includes the lower sideslopes of glacial U-shaped valleys that have a canopy cover greater than 40 percent. These sideslopes are concave in shape, located below the Upper Sideslope landtypes (31 and 32) and above valley bottoms.

The Forested Concave Lower Sideslope landtype generally occurs at elevations ranging from 150 to 550 m (500 to 1800 ft). Slope gradients are moderately steep (15 to 45 percent) with slope lengths from 150 to 610 m (500 to 2000 ft). These Forested Lower Sideslopes usually have a north to west aspect and/or are located where the avalanche activity is low to moderate.

Soils and Vegetation:

The soils of the Forested Concave Lower Sideslop landtype are formed in deposits of well-fitted to compacted glacial till and accumulations of soil and rocks eroded from the slopes above. Windblown deposits also compose part of the soil surface. Approximately 50 percent of the landtype has a vegetative cover of mountain hemlock and some white spruce, with rusty menziesia, crowberry, bunchberry, five-leaf bramble and mosses. The soils of this area which are represented by soil number 6 are deep and well to somewhat excessively drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to sandy loam texture with 5 to 15 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

About 20 percent of the Forested Concave Lower Sideslope landtype has a vegetative cover of sitka alder with red elderberry, bluejoint grass, ferns and horsetail. The soils of this area which are represented by soil number 7 are deep and moderately well drained. The surface soil and subsoil have silt loam textures and lack any coarse fragments. Beneath the solum the substratum has a loam to sandy loam texture with 20 to 30 percent gravel and 10 to 20 percent cobbles. The soil in this layer is compact to well-fitted in place and is restrictive to drainage.

Approximately 15 percent of the landtype has a canopy cover of white spruce, mountain hemlock and paper birch with lowbush cranberry, blueberry, rusty menziesia, bunchberry, fireweed and mosses. A paper birch canopy is predominant in areas that have a fire history. The soils in this area which are represented by soil number 1 are deep and well-drained. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a loam to fine sandy loam texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles. The gravel and cobbles are angular.

About 10 percent of the landtype which occupies the higher elevations has a thick cover of bluejoint grass, with shrub willow, dwarf birch, fireweed, other forbs and mosses. The soils of this area which are represented by soil number 8 are deep and moderately well to well drained. The surface soil has a silt loam texture with about 5 percent gravel. The subsoil has textures ranging from a loamy coarse sand to a sandy loam with 20 to 25 percent gravel and 10 to 25 percent cobbles. Beneath the solum the substratum has a loamy coarse sand texture with 35 percent gravel and 15 percent cobbles. The soil is compact to well-fitted in place and is restrictive to water drainage through it.

The remaining approximate 5 percent of the Forested Concave Lower Sideslope landtype has a vegetative cover of white spruce with sitka alder, crowberry, horsetail and sphagnum moss. The soils of this area which are represented by soil number 5 are a deep and poorly drained mat of highly decomposed organic debris over glacial till and rock. The organic surface soil is a muck which has a sapric texture with minimal fiber content. Beneath the surface organic soil there is a thin layer of mineral soil which has a loam texture with about 50 percent gravel and about 5 percent cobbles. The organic subsoil is also a muck which has a sapric texture with no fiber content. Beneath the solum the mineral substratum has a loam to sandy loam texture with about 50 percent gravel and about 10 percent cobbles.

Management Considerations:

The Forested Lower Sidelope landtype has some suitable areas for timber management activities. There are moderate restrictions on recreational development and road construction due to moderately steep slopes and a high surface erosion hazard if mineral soil is exposed by cut and fill trail or road construction. Those sections of the landtype represented by soil numbers 1 and 8 also have a high surface erosion hazard if the vegetative cover is removed. Severe restrictions for shallow excavations occur in those areas characterized by soil number 1 due to the high volume of coarse fragments. There are severe restrictions for most management activities in areas represented by soil number 8 due to the presence of a cemented pan within 100 cm (39 in) of the soil surface.

Concave Lower Sideslope - Non-forested Landtype

Map Symbol: 34

Landtype Description:

The Non-forested Concave Lower Sideslope landtype of the Glacial Sideslope Landtype association includes the lower sideslopes of glacial U-shaped valleys that have a canopy cover less than 40 percent. These sideslopes are concave in shape, located below the upper sideslope landtypes (31 and 32) and above valley bottoms. Inclusions of the Scree Fan landtype (35) are present in this landtype where they are too small to be mapped separately.

The Non-forested Concave Lower Sideslope landtype generally occurs at elevations ranging from 180 to 700 m (600 to 2300 ft). Slope gradients are moderately steep (15 to 45 percent) with slope lengths from 150 to 610 m (500 to 2000 ft). These non-forested lower sideslopes usually occur on east, south and west aspects and/or where avalanche activity is moderate to high.

Soils and Vegetation

The soils of the Non-forested Concave Lower Sideslope landtype are formed in deposits of well-fitted to compact glacial till and accumulations of soil and rock eroded from the slopes above. Windblown deposits also compose part of the soil surface. Approximately 30 percent of the landtype has a dense vegetative cover of bluejoint and other grasses, along with spirea, fireweed, horsetail, cow parsnip, sitka alder and shrub willow. The soils of this area which are represented by soil number 9 are deep and well drained. The surface soil has a loamy fine sand texture with about 15 percent gravel and about 15 percent cobbles. The subsoil has a sandy loam to fine sandy loam texture with 20 to 25 percent gravel

and 10 to 15 percent cobbles. Beneath the solum the substratum has a fine sandy loam texture with 35 percent gravel and 10 percent cobbles.

About another 30 percent of the Non-forested Concave Lower Sideslope landtype has a thick vegetative cover of sitka alder with salmonberry, red elderberry, woodfern, fireweed and mosses. The soils of this area which are also represented by soil number 9 have been described above.

Approximately 20 percent of the landtype has a mixed vegetative cover mountain hemlock and white spruce with shrub willow, dwarf birch, crowberry, grass and moss. The soils of this area which are represented by soil number 6 are deep and well drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to a sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

The remainig approximate 20 percent of the Non-forested Concave Lower Sideslope landtype is found on naturally disturbed and wet sites with water seeping along a compact glacial till contact. The vegetative cover is composed of sitka alder, some elderberry and shrub willow, with ferns, grasses, sedges and mosses. The soils of this area which are represented by soil number 10 are deep and moderately well-drained. Above the surface soil is a thick mat of highly decomposed organic material. The surface soil has a loam texture and no coarse fragments. The subsoil has a fine sandy loam to loamy sand texture with 5 to 15 percent gravel. Beneath the solum the substratum has a sandy loam texture with 20 percent gravel. This soil is compact to well-fitted in place and is restrictive to drainage.

Management Considerations:

The Non-forested Concave Lower Sideslope landtype has moderate restrictions for trail construction and severe restrictions for recreational development and road construction due to the moderately steep slopes. There is a high avalanche hazard with a sitka alder, salmon berry, fern and red elderberry vegetative cover. Severe restrictions for shallow excavations and road construction occur in sections of the landtype represented by soil number 10 due to the presence of a cemented pan within 100 cm (39 in) of the soil surface.

Scree Fan Landtype

Map Symbol: 35

Landtype Description:

The Scree Fan landtype of the Glacial Sideslope landtype association includes fan-shaped accumulations of soil and rock at the base of deeply incised V-shaped drainages and avalanche chutes. These fans have extremely high avalanche activity. Deep accumulations of snow and avalanche debris cover the fans during the winter months and small streams run through them during the summer. This landtype is usually located below the Upper Sideslope landtypes (31 and 32). The fans are associated with and may be mapped as inclusions in the Concave Lower Sideslope landtypes (33 and 34) where they are too small to be mapped as a separate unit.

The Scree Fan landtype generally occurs at elevations ranging from 150 to 550 m (500 to 1800 ft). Slope gradients are steep (20 to 70 percent) with slope lengths from 240 to 450 m (800 to 1500 ft).

Soils and Vegetation:

The soils of the Scree Fan landtype have formed on alluvial/colluvial deposits of soil and rock. Approximately 65 percent of the landtype has a dense vegetative cover of sitka alder with ferns, twisted stalk, forbs and mosses. This cover type is usually found on the upper part of the fans where the depositional material is not well sorted. The soils of this area which are represented by soil number 11 are deep and well drained. The surface soil has a loam texture with about 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is layered. The texture of these layers range from a loam to coarse sand, and the coarse fragment contents range from 25 to 50 percent gravel and 20 to 30 percent cobbles.

About 30 percent of the landtype has a thick vegetative cover of grass and sedge, with dwarf birch, crowberry and forbs. The soils of this area which are represented by soil number 12 are deep and well drained. The surface soil has a silt loam texture with 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is layered. The texture of these layers range from a sandy loam to a coarse sand with 40 to 70 percent gravel, about 15 percent cobbles, and up to 40 percent stones.

The remaining approximate 5 percent of the Scree Fan landtype are stable areas with a vegetative cover of mountain hemlock with sitka alder, grasses and forbs. The soils of this area which are represented by soil number 6 are deep and well drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

Management Considerations:

The Scree Fan landtype has severe restrictions for most management activities due to steep slopes and a moderate to very high avalanche hazard. There is a high surface erosion hazard if mineral soil is exposed by cut and fill road or trail construction. In areas of the landtype represented by soil number 11, severe restrictions for shallow excavations and road construction also exist due to the high volume of large stones greater than 8 cm (3 in) and coarse fragments throughout the profile.

ICE AND SNOW LANDTYPE ASSOCIATION

Map Symbol: IS

Association Description:

The Ice and Snow landtype association is common to both the Resurrection/Six Mile and Kenai Remnant Glaciers sections of the Chugach National Forest. This association has not been mapped into its component landtypes on the Kenai Peninsula.

This landtype association includes perennial ice and snow fields with minor inclusions of exposed bedrock. There are no typical soils or vegetation types described for this landtype association and it generally occurs at elevations above 760 m (2500 ft)(8).

Management Considerations:

The Ice and Snow landtype association has severe limitations for all management activities.

GLACIAL MORAINE LANDTYPE ASSOCIATION

Map Symbol: GM

Association Description:

The Glacial Moraine landtype association is common to both the Resurrection/Six Mile and Kenai Remnant Glacier sections of the Chugach National Forest. Much of this association has been mapped into its component landtypes for the high use areas of the Kenai Peninsula.

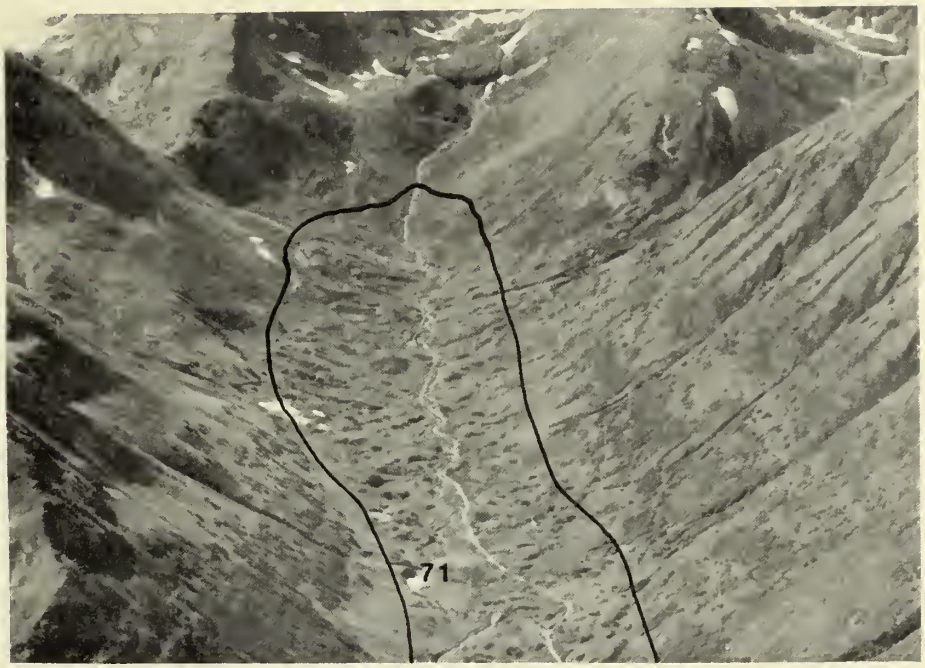
The glacial moraines include mounds and outwash plains of nonsorted soil and rock that were left by retreating glaciers. Units of the association occur at the junction of two glaciers, along the lower sideslopes, and in the bottoms of glacial U-shaped valleys. Most relief is mounds which range in height from 3 to 30 m (10 to 100 ft) with slope gradients of 25 to 65 percent. It is common to find ponds, lakes and muskegs in the lowlying areas. Many of the glacial outwash plains have a hummocky topography with small hills up to 5 m (15 ft) high. Braided streams wind their way through most of the plains.

A forest with a spruce-hemlock overstory and a blueberry, devil's club and moss understory is typical of the land unit. The areas nearer to active streams commonly have a willow and alder cover. The wet low lying areas contain black spruce, dwarf birch, moss and sedge(8).

The landtypes that are included in this Glacial Moraine landtype association are: Low Relief Moraines with Outwash Plains (71); and High Relief Moraines (72).

Low Relief Moraine with Outwash Plain Landtype

Map Symbol: 71



Landtype Description:

The Low Relief Moraine with Outwash Plain landtype includes small rounded morainal deposits that were left by retreating glaciers. This landtype is located in valley bottoms at the head of glacial U-shaped valleys. Morainal mounds range from 3 to 10 m (10 to 30 ft) in height are a common feature of surface relief. Between these mounds braided streams have meandered across the morainal plains leaving nearly level outwash deposits. Small ponds, stream, and wet flood plains are common to those flat, low-lying areas. Inclusions similar to parts of the Low-lying Floodplain landtype (82) are present in this landtype where they are too small to map as separate units.

The Low Relief Moraine landtype generally occurs at elevations ranging from 270 to 610 m (900 to 2000 ft). Slope gradients are moderately steep (15 to 40 percent) on the mounds and slight (less than 5 percent) on the outwash plains.

Soil and Vegetation:

The soils of the Low Relief Moraine with Outwash Plain landtype have formed in nonsorted and slightly reworked deposits of glacial till that were dumped by retreating glaciers. Approximately 90 percent of the landtype has a dense vegetative cover of willow, leutkea, club moss, and sedges with a sparce cover of mountain hemlock. The soils of this area which are represented by soil number 1 are deep and well-drained. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has

a loam to fine sandy loam texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles. The gravel and cobbles are angular.

The remaining 10 percent of the Low Relief Moraine with Outwash Plain landtype is similar to the Low-lying Floodplain landtype (82) described in this report, and has a vegetative cover of shrub willow, dwarf birch and alder, with fireweed, grasses, sedges and mosses. The soils of this area which are represented by soil number 14 are deep and poorly drained with the water table within 100 cm (39 in) of the surface. Above the surface soil is a mat of highly decomposed organic material. The surface soil has a loamy fine sand texture and lacks any coarse fragments. A subsoil is not present. Beneath the solum the substratum is layered. The upper layer has a fine sandy loam texture also without any coarse fragments. The lower layer has a very coarse sand texture with 75 percent gravel and 15 percent cobbles.

Management Considerations:

Most of the Low Relief Moraine with Outwash Plain landtype has few restrictions for recreational development and road and trail construction. The landtype is especially well suited for winter recreational trails. The areas with severe management restrictions are on the mounds where slopes are moderately steep and on the low-lying floodplains where flooding and wetness are a problem.

High Relief Moraine Landtype

Map Symbol: 72

Landtype Description:

The High Relief Moraine landtype includes large rounded morainal deposits that were left along the sides and at the terminus of retreating glaciers. This landtype is located at the junction of two glacial valleys, along the lower sideslopes and in the bottom of glacial U-shaped valleys. Common surface features are morainal mounds which range from 10 to 30 m (30 to 100 ft) in height. Muskegs, wet areas, and small ponds are common features in the low-lying areas and between the mounds.

The High Relief Moraine landtype generally occurs at elevations ranging from 210 to 360 m (700 to 1200 ft). Slope gradients are moderate (5 to 30 percent) on the mounds and slight (less than 5 percent) on the low-lying areas. Slope lengths are from 10 to 60 m (30 to 200 ft).

Soil and Vegetation:

The soils of the High Relief Moraine landtype have formed in unsorted and slightly reworked deposits of glacial till that were dumped by retreating glaciers. Approximately 70 percent of the landtype has a vegetative cover of mixed white spruce, mountain hemlock and paper birch with rusty menziesia, blueberry, five-leaf bramble, fireweed and mosses. The soils of this area which are represented by soil number 2 are deep and well drained. The surface soil has a loam texture with about 20 percent gravel and about 20 percent cobbles. The subsoil has a sandy loam texture with 20 to 35 percent gravel and

30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles.

About 15 percent of the High Relief Moraine landtype are old drainage channels that have a dense vegetative cover of grasses and alder with ferns, blueberry and mosses. The soils of this area which are represented by soil number 6 are deep and well drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to a sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

The remaining approximate 15 percent of the landtype has a muskeg vegetative cover with dwarfed black spruce, willow, labrador tea, dwarf birch, crowberry and sphagnum moss. The soils of this area which are represented by soil number 5 are a deep and poorly drained mat of highly decomposed organic debris over glacial till and rock. The organic surface soil is a muck which has a sapric texture with some fiber content. The organic subsoil is also a muck which has a sapric texture with almost no fiber content. Beneath the solum the mineral substratum has a loam to sandy loam texture with about 50 percent gravel and about 10 percent cobbles.

Management Considerations:

The High Relief Moraine landtype is suitable for timber management activities. There are moderate restrictions for recreational development and road and trail construction throughout most of the landtype due to moderate slopes. In areas of the landtype represented by soil number 2 there are severe limitations for the developement of sanitary facilities due to slow permeability in the substratum. There are severe limitations to management activities in the low-lying basins due to a high water table and deep organic soils.

GLACIAL OUTWASH LANDTYPE ASSOCIATION

Map Symbol: GO

Association Description:

The Glacial Outwash Landtype Association is common to both the Resurrection/Six Mile and Kenai Remnant Glacier sections of the Chugach National Forest. Much of this association has been mapped into its component landtypes for high use areas of the Kenai Peninsula. Some major differences within the Glacial Outwash landtype associations exist at the landtype level between the two different sections. These differences will be explained in the individual landtype descriptions.

The Glacial Outwash Landtype Association occurs along the bottom and at the mouth of glacial U-shaped valleys. Well-drained river terraces or benches, alluvial fans, valley trains and flat outwash plains are included in this mapping unit. In some locations steep sideslopes have been cut by streams into previously deposited material or bedrock. Most all of the soil in this landtype association has been deposited and often reworked by water to a

variable extent. The material that is near the streams is often loose and is susceptible to erosion and periodic flooding. The slope gradient is generally less than 20 percent over the association except on the stream cut sideslopes which range from 50 to 100 percent.

A spruce-hemlock vegetative cover type is found on many of the well drained valley trains, alluvial fans, and outwash plains of glacial

outwash. A mixed spruce-hemlock and birch vegetative cover type is found on areas which have had a fire history. A cottonwood, alder and willow vegetative cover are found along active streams and on their floodplains. The understory is often composed of rusty menziesia, blueberry, crowberry, forbs and grasses(8).

The landtypes that are included in the Glacial Outwash landtype association are: Alluvial Fan (81); Low-lying Floodplain (82); Unvegetated Stream Channel (83); River Cut Sideslope into Alluvium and Till (84); River Cut Sideslope into Bedrock (85); High Elevation Valley Train (86); Alluvium and Till Bench (87); Alluvial Terrace (88); Outwash Plain - Forested (89).

Alluvial Fan Landtype

Map Symbol 81

Landtype Description:

The Alluvial Fan landtype of the Glacial Outwash landtype association includes fan-shaped alluvial deposits. These fans often form along the lower sideslopes and in the bottoms of glacial valleys at the outlet of side drainages where the stream gradient decreases. They often have formed over till and outwash that had previously been deposited in the valley bottoms. Streams flowing from the tributary drainages change course and meander across the fan depositing soil and rock from the upper slopes. The coarser gravels and cobbles are deposited near to the mouth of the stream channel with the fines transported further away.

The Alluvial Fan landtype generally occurs at elevations ranging from 120 to 450 m (400 to 1500 ft). Slope gradients are nearly level to moderate (0 to 20 percent) with slope lengths from about 150 to 450 m (500 to 1500 ft).

Section Differences:

The Alluvial Fan landtype is not the same on the Resurrection/Six Mile and the Kenai Remnant Glacier sections of the Kenai Peninsula. The soils of the landtype are very similar in both sections but the vegetative cover differs. The vegetation descriptions below are for those areas in the Resurrection/Six Mile section. Vegetative cover on these areas in the Kenai Remnant Glacier section have more sitka spruce with western or mountain hemlock than white spruce with birch.

Soils and Vegetation:

The soils of the Alluvial Fan landtype have formed on alluvial deposits of silts, sands and rounded gravels. Approximately 60 percent of the landtype has a vegetative cover of white spruce, birch, quaking aspen and black cottonwood with willow, prickly rose, blueberry, fireweed and other forbs and mosses. The soils of this area which are represented by soil number 11 are deep and well-drained. The surface soil has a loam texture with about 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is multi-layered. The texture of these layers range from a loam to coarse sand with the coarse fragment content ranging from 25 to 50 percent gravel and 20 to 30 percent cobbles.

About 20 percent of the Alluvial Fan landtype is located adjacent to stream channels. This area has a vegetative cover of black cottonwood and sitka alder with white spruce, devil's club, red elderberry, ferns, bluejoint grass and mosses. The soils of this area which are represented by soil number 12 are deep well-drained layers of sands, gravels and cobbles. The surface soil has a silt loam texture with 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is layered. The texture of these layers range from a sandy loam to a coarse sand. Coarse fragment contents range from 40 to 70 percent gravel with about 15 percent cobbles, and about 40 percent stones.

Approximately another 10 percent of the landtype has a thick cover of shrub and dwarf willow with some white spruce, black cottonwood, fireweed, bunchberry, and other forbs and mosses. The soils of this area which are represented by soil number 13 are deep and moderately well drained. The surface soil has a sandy loam texture with 15 percent gravel. A subsoil is not present. Beneath the solum the substratum is multiple layers of stratified alluvium which are sorted and stratified by their particle size. The texture of these layers range from a silt loam to a coarse sand and the coarse fragment contents range from 5 to 70 percent gravel.

The remaining approximate 10 percent of the Alluvial Fans landtype is located on the outer edge of the fans. This area has a vegetative cover of white spruce and birch, with blueberry, fireweed, grasses and mosses. The soils of this area which are represented by soil number 1 are deep and well drained. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a loam to fine sandy loam texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles.

Management Considerations:

Most of the Alluvial Fan landtype is well suited for timber management, recreational development and road construction. Areas adjacent to stream and overflow channels have severe limitations due to instability and a high flood hazard. There are severe limitations for shallow excavations and sanitation facilities in sections of the landtype represented by soil numbers 11, 12 and 1 due to the large amount of coarse fragments in the substratum. This makes shallow excavations difficult and serves as a poor filtering medium. A large volume of large stones greater than 8 cm (3 in) in those areas represented by soil number 12 also create severe restrictions for shallow excavations and road construction. Those areas represented by soil numbers 11 and 1 are a fair to good source of roadfill material and gravel.

Low-lying Flood Plain Landtype

Map Symbol: 82

Landtype Description:

The Low-lying Flood Plain landtype of the Glacial Outwash landtype association includes low-lying areas in valley bottoms along active stream channels. Most of this landtype will be flooded or have the water table at or near the surface during seasonally high stream flows. The surface of the landtype may often be hummocky and/or highly dissected with old stream channels.

Units of Low-lying Flood Plains landtype which are usually small in size may exist as inclusions in the Low Relief Moraine with Outwash Plain (71); Outwash Plain - Forested (89); High Elevation Valley Train (86); and Alluvial Terrace (88) landtypes. The Low-lying Flood Plain landtype may have inclusions of the Unvegetated Stream Channel landtype (83) which are too small to be mapped separately.

The low-lying flood plain landtype generally occurs at elevations ranging from 120 to 700 m (400 to 2300 ft). Slope gradients are nearly level (0 to 5 percent).

Soils and Vegetation:

The soils of the Low-lying Flood Plain landtype have formed on alluvial deposits and are stronly influenced by the depth of the water table. The soil surface may often include a thick build-up of organic material. Approximately 70 percent of the landtype is located adjacent to active stream channels and has a vegetative cover of shrub willow, dwarf birch and alder, with fireweed, grasses, sedges and mosses. The soils of this area which are represented by soil number 14 are deep and poorly drained with the water table

within 100 cm (39 in) of the surface. Above the surface soil is a mat of highly decomposed organic material. The surface soil has a loamy fine sand texture and lacks any coarse fragments. A subsoil is not present. Beneath the solum the substratum is layered. The upper layer has a fine sandy loam texture also without any coarse fragments. The lower layer has a very coarse sand texture with 75 percent gravel and 15 percent cobbles.

The remaining approximate 30 percent of the Low-lying Flood Plain landtype is located away from the active stream channels and has an open vegetative cover of white spruce with dwarf birch, bunch grass, fireweed, other forbs and mosses. The soils of this area which are represented by soil number 11 are deep and well to moderately well drained. The surface soil has a loam texture with about 25 percent gravel. A subsoil has a loam texture with about 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is multi-layered. The texture of these layers range from a loam to a coarse sand, and the coarse fragment content ranges from 25 to 50 percent gravel and 20 to 30 percent cobbles.

Management Considerations:

The Low-lying Flood Plain landtype has severe limitations for most management activities due to a high flood hazard throughout the area. Sections of the landtype represented by soil number 14 have water at or near the surface throughout the year which severely limits its use. This landtype is a fair source for roadfill material and those areas represented by soil number 11 are a good source of gravel.

Unvegetated Stream Channel Landtype

Map Symbol: 83

Landtype Description:

The Unvegetated Stream Channel landtype of the Glacial Outwash landtype association includes areas in valley bottoms maintained without continuous vegetative cover by stream activity. The water table in the landtype is often just below the soil surface and the area is flooded during high stream flows.

Units of the Unvegetated Stream Channels landtype which are too small to be mapped separately can exist as inclusions in the Outwash Plain - Forested (89), High Elevation Valley Train (86), Low-lying Flood Plain (82) and Alluvial Terrace (88) landtypes. The landtype is typically very unstable due to the continual changes in channel location, flooding and additions of alluvial deposition, but occasionally the sand and gravel bars along the channels are stabilized by vegetation.

The Unvegetated Stream Channels landtype generally occurs at elevations ranging from 120 to 700 m (400 to 2300 ft). Slope gradients are nearly level (0 to 3 percent).

Section Differences:

The Unvegetated Stream Channel landtype is not equally distributed between the Resurrection/Six Mile and the Kenai Remnant Glacier sections of the Kenai Peninsula. The landtype is more extensive and developed as a landform in the Kenai Remnant Glacier section. The soils and vegetation of the landtype are very similar in both sections.

Soils and Vegetation: The soils of the Unvegetated Stream Channels landtype have formed on alluvial deposits which are strongly influenced by the height of stream flow. The occasionally small vegetated areas of this mostly unvegetated landtype have a cover of shrub willow, alder, fireweed and grass. The soils of this landtype which are represented by soil number 14 are deep and poorly drained with the water table within 100 cm (39 in) of the surface. The surface soil has a loamy fine sand texture and lacks any coarse fragments. A subsoil is not present. Beneath the solum the substratum is layers of alluvium which are stratified and roughly sorted by their particle size. The texture of these layers range from a fine sandy loam with no coarse fragments, to a very coarse sand with 75 percent gravel and 15 percent cobbles.

Management Considerations: The Unvegetated Stream Channel landtype has severe limitations for most management activities due to a very high flood hazard and a high water table throughout the year.

River Cut Sideslope - Alluvium and Till Landtype

Map Symbol: 84

Landtype Descriptions:

The River Cut Sideslope into Alluvium and Glacial Till landtype of the Glacial Outwash landtype association includes steep sideslopes cut into deposits of alluvium or glacial till adjacent to an active creek or river. These sideslopes are fairly stable except where the channel is presently undercutting and the bank is eroding back to reestablish a stable slope.

Units of this landtype which are too small to be mapped separately can exist as inclusions in the Alluvial and Till Bench (87) landtype. The River Cut Sideslope into Alluvium and Till landtype may have inclusions of the River Cut Sideslope into Bedrock landtype (85) which are too small to be mapped separately.

The River Cut Sideslope into Alluvium and Till landtype generally occurs at elevations ranging from 120 to 760 m (400 to 2500 ft). Slope gradients are extremely steep (50 to 90 percent).

Soils and Vegetation:

The soils of this River Cut Sideslopes landtype have formed on deposits of alluvium and glacial till. Approximately 75 percent of the landtype has a vegetative cover of white spruce and paper birch with some alder, rusty menziesia, prickly rose, lowbush cranberry, bunchberry, ferns and other forbs and mosses. The soils of this area which are represented by soil number 11 are deep and well-drained. The surface soil has a loam texture with about 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is

multi-layered. The texture of those layers range from a loam to coarse sand and the coarse fragment content ranges from 25 to 50 percent gravel and 20 to 30 percent cobbles.

About 10 percent of the River Cut Sideslope into Alluvium and Till landtype has a vegetative cover similar to that described above, but it has a different soil. The soils of this area which are represented by soil number 4 are well drained and shallow with bedrock within 20 to 50 cm (8 to 20 in) of depth from the surface. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a sandy loam texture with about 20 percent gravel and 15 to 20 percent cobbles. Bedrock of shale and/or graywacke is beneath the solum at about 38 cm (15 in).

Approximately another 10 percent of the landtype has a vegetative cover of predominantly alder shrubs and grass with some shrub willow, crowberry, fireweed and other forbs. The soils of this area which are represented by soil number 6 are deep and well drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

The remaining approximate 5 percent of the River Cut Sideslopes into Alluvium and Till landtype is in areas where active undercutting and erosion of the sideslope is occurring. These areas do not have a vegetative cover. The soils of this area which are represented by soil number 11 have been described above.

Management Considerations:

The River Cut Sideslopes into Alluvium and Till landtype has severe limitations to most management activities due to extremely steep slopes. There is a high soil creep hazard and a very high surface erosion hazard if the vegetative cover is removed and mineral soil is exposed by cut and fill road or trail construction. There is also a low or very low revegetation potential and a high slumping and slippage hazard in all slopes that are cut and filled. In sections of the landtype represented by soil number 11 a high flooding hazard exists adjacent to stream channels.

River Cut Sideslopes - Bedrock Landtype

Map Symbol: 85

Landtype Description:

The River Cut Sideslopes into Bedrock landtype of the Glacial Outwash landtype association includes steep sideslopes cut into bedrock adjacent to an active stream or river. These sideslopes are stable except in areas where seepage of water over the rock has caused slumping and slippage of overlying soil material. Units of this landtype which are too small to be mapped separately can exist as inclusions in the River Cut Sideslopes into Alluvium and Till (84) landtype.

The River Cut Sideslopes into Bedrock landtype genrally occurs at elevations ranging from 120 to 760 m (400 to 2500 ft). Slope gradients are extremely steep (50 to 100 percent).

Soils and Vegetation:

The soils of these River Cut Sideslopes have formed on deposits of till and alluvium which is underlain by bedrock. Approximately 40 percent of the landtype has a vegetative cover of paper birch, mountain hemlock and white spruce with blueberry, willow, crowberry, bunchberry, other forbs and mosses. The soils of this area which are represented by soil number 6 are deep and well drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

About 20 percent of the River Cut Sideslopes into Bedrock landtype has a vegetative cover of predominantly mountain hemlock, some white spruce and paper birch, with willow, crowberry and mosses. The soils of this area which are represented by soil number 4 are well drained and shallow with bedrock within 20 to 50 cm (8 to 20 in) of depth from the surface. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a sandy loam texture with about 20 percent gravel and 15 to 20 percent cobbles. Bedrock of shale and/or graywacke is beneath the solum at about 38 cm (15 in).

Approximately another 20 percent of the landtype has a dense canopy of sitka alder and red elderberry with shield fern and grasses. This area has water seeping along the bedrock. The soils of this area which are represented by soil number 15 are a thin and somewhat poorly drained mat of organic material, with bedrock at about 26 cm (10 in). The organic surface soil is a peaty muck with a hemic texture and a moderately high fiber content. The organic subsoil is a mucky peat with a hemic texture and a moderate amount of fiber. The subsoil also has about a 10 percent mineral content. Bedrock of shale is beneath the solum.

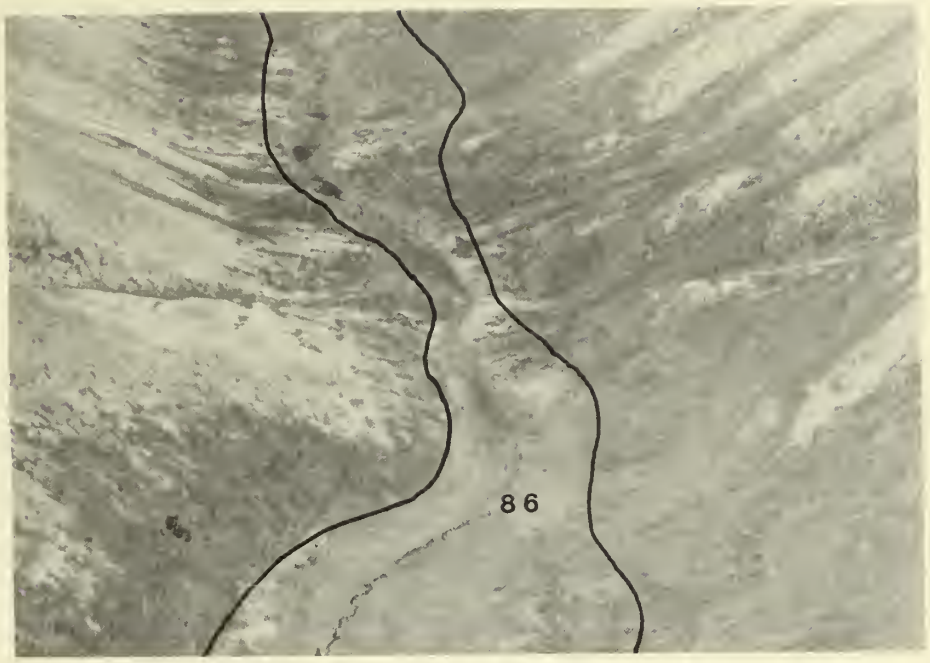
The remaining approximate 20 percent of the River Cut Sideslopes into Bedrock landtype is exposed bedrock outcrops with little soil and vegetative cover.

Management Considerations:

The River Cut Sideslope into Bedrock landtype has severe limitations for most management activities due to the extremely steep slopes. Sections of the landtype represented by soil numbers 4 and 15 have bedrock within 50 cm (20 in) of the soil surface. There are small exposed rock outcrops throughout the landtype. Areas represented by soil numbers 6 and 4 have a high soil creep hazard along with a high to very high slump hazard and very high surface erosion hazard if the vegetative cover is removed and mineral soil is exposed by cut and fill road or trail construction.

High Elevation Valley Train Landtype

Map Symbol: 86



Landtype Description:

The High Elevation Valley Train landtype of the Glacial Outwash association includes sparcely treed narrow valleys bottoms at elevations generally above 420 m (1400 ft). The slope gradients are gentle (0 to 15 percent) and streams meander through the valleys. Abandoned stream channels and overflow paths disect the valley floors. Depressions and low areas adjacent to existing streams may be wet and poorly drained. Material in some locations is eroded from the valley sideslopes and deposited on the landtype by stream activity.

The High Elevation Valley Train landtype may have inclusions of the Low-lying Flood Plain (82) and Unvegetated Stream Channel (83) landtypes which are too small to be mapped separately.

Soils and Vegetation:

The soils of the High Elevation Valley Train landtype have formed on deposits which aggrade the valley floor. These deposits may be of glacial till which are often stream reworked; alluvial/colluvial material from the valley sideslopes; and some alluvium along the active and abandoned stream channels. Some deposits of alluvium and reworked till have layers of varying textures and degree of stratification while others are poorly sorted. The coarse fragments in these deposits are subangular to rounded and of varying size class. Approximately 50 percent of the landtype has a vegetative cover of shrub willow, sedges, crowberry and mosses. The soils of this area which are represented by soil number 16 are deep and poorly

drained with the water table within 50 cm (20 in) of the surface. Above the surface soil there is a thick mat of highly decomposed organic material. The surface soil has a silt loam texture with 5 percent gravel. A subsoil is not present. Beneath the solum the substratum has a loam to loamy sand texture with 60 to 70 percent gravel and about 5 percent cobbles.

About 40 percent of the High Elevation Valley Trains landtype has a dense vegetative cover of bluejoint and other grasses, sedges, and mosses with crowberry, dwarf birch, wintergreen, bunchberry and other forbs. The soils of this area which are represented by soil number 2 are deep and well drained. The surface soil has a loam texture with about 20 percent gravel and about 20 percent cobbles. The subsoil has a sandy loam texture with 20 to 35 percent gravel and 30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles.

The remaining approximate 10 percent of the landtype is found in former drainage channels and depressions which have a high water table and are subject to intermittent flooding. The area has a vegetative cover of grasses, sedges, sphagnum moss, and forbs with some shrub blueberry. The soils of this area which are represented by soil number 17 are a deep and poorly drained accumulations of interbedded organic and mineral layers with the water table within 50 cm (20 in) of the surface. The organic surface soil is a peaty muck which as a hemic texture with some fiber content. Beneath the surface organic soil there is a layer of mineral soil which has a silt texture and no coarse fragment content. This may be ash of volcanic origin. The organic subsoil is a muck to mucky peat which has a sapric texture with little fiber content. Beneath the solum the mineral substratum has a silt texture with no coarse fragment content.

Management Considerations:

Most of the High Elevation Valley Train landtype is suitable for trail construction. Some limitations for recreational development and road construction exist due to high altitudes and the moderate slopes at the valley sides. These valleys are often inaccessible to vehicles. Sections of the landtype represented by soil number 16 also have a high frost action potential and a high water table. Those areas characterized by soil number 17 are found in low-lying areas and have severe limitations for most management activities due to ponding and wetness throughout the year and a high flood hazard. Construction of cabins and other structures should be avoided on this landtype in areas below V-notched upper sideslopes. Many of these V-notches are avalanche chutes in the winter which release snow and debris across the valley floor.

Alluvial and Till Bench Landtype

Map Symbol: 87

Landtype Description:

The Alluvial and Till Bench landtype of the Glacial Outwash landtype association includes benches often found below the Concave Lower Sideslope landtypes (33 and 34) and above the River Cut Sideslope landtype (84 and 85) beyond the effects of flooding. The benches are remnant features indicating a former bottom to the glacial U-shaped valley which has been incised by a post glacial stream. Often these benches are also disected perpendicularly by tributaries flowing down from the upper sideslopes.

The Alluvial and Till Bench landtype generally occurs at elevations ranging from 150 to 760 m (500 to 2500 ft). Slope gradients are gentle to moderate (0 to 15 percent) on the benches. Deeply incised V-shaped drainage channels which cross the benches along with small inclusions of the River Cut Sideslope landtypes (84 and 85) have steep slopes (35 to 80 percent).

Soils and Vegetation:

The soils of the Alluvial and Till Bench landtype have formed on deposits of glacial till, water reworked till, lake sediments and alluvium. There is a wide variety of soil textures, degree of sorting and stratification of the deposits making up these benches. Some areas have compact to well-fitted glacial till near the surface which impedes drainage. Approximately 35 percent of the landtype has a vegetative cover of white spruce and mountain hemlock with spirea, fireweed, other forbs and mosses. The soils of this area which are represented by soil number 2 are deep and well drained. The surface soil has a loam texture with about 20 percent gravel and about 20

percent cobbles. The subsoil has a sandy loam texture with 20 to 35 pecent gravel and 30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles.

About 30 percent of the Alluvial and Till Bench landtype has a vegetative cover of white spruce, quaking aspen, paper birch, and mountain hemlock with willow, rusty menziesia, fireweed, crowberry, bunchberry, grasses and mosses. The soils of this area which are represented by soil number 6 are deep and well to somewhat excessively drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum, the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

Approximately 15 percent of the landtype has a dense vegetative cover of sitka alder, currant, bunchberry, horsetail, clubmoss, and mosses. This area is strongly influenced by a very slowly permeable layer of fine textured till in the substratum. The soils of this area which are represented by soil number 18 are deep and somewhat poorly drained with the water table within 100 cm (39 in) of the surface. The surface soil is a thick mat of highly decomposed organic material with a sapric texture and no coarse fragments. The subsoil has a loam to sandy loam texture with up to about 10 percent gravel and 10 to 25 percent cobbles. Beneath the solum the substratum has a clay loam texture with about 30 percent gravel and about 10 percent cobbles. This layer is very slowly permeable and has water seeping above it.

About 10 percent of the Alluvial and Till Bench landtype has a thick vegetative cover of willow and blueberry shrubs with sitka burnette, fireweed, crowberry, grasses and mosses. These areas are near former stream channels and in the higher elevations. The soils of this area which are represented by soil number 19 are deep and moderately well drained. The surface soil has a silt loam texture without any coarse fragments. Beneath the solum the substratum is layered. The texture of these layers range from a sand to sandy loam textures with 10 to 70 percent gravel and 15 to 30 percent cobbles.

Approximately 5 percent of the landtype has a thick vegetative cover of sitka alder, rusty menziesia and blueberry shrubs with horsetail, five-leaf bramble, grasses and mosses. The surface is characterized by ground water seeps. These seeps are caused by a very slowly permeable layer of fine textured glacial till. The soils of the area which are represented by soil number 20 are deep and somewhat poorly drained with the water table within 100 cm (39 in) of the surface. The surface soil is a thick mat of highly decomposed organic material with a sapric texture and no coarse fragments. The subsoil has a loam to silt loam texture with 0 to 5 percent gravel. Beneath the solum the substratum has a silty clay loam texture with about 5 percent gravel and about 25 percent cobbles.

The remaining about 5 percent of the Alluvial and Till Bench landtype is small muskegs. This area has a thick moss carpet with an open vegetative cover of black spruce, white spruce, thinleaf alder, horsetail, bunchberry and sitka burnette. The soils of this area which are represented by soil number 21 are a deep build-up of organic material which is poorly drained with the water table found within 50 cm (20 in) of the surface. The organic surface soil is a

peaty muck which has a hemic texture with a moderate fiber content. The organic subsoil is a mucky peat which has a sapric texture with some fiber content. Beneath the solum at a depth greater than 100 cm (39 in) is a substratum of mineral soil.

Management Considerations:

Sections of the Alluvium and Till Bench landtype which are represented by soil numbers 2 and 6 are suitable for timber management. There are moderate limitations for recreational development and trail and road construction due to moderate slopes in the bench areas and steep slopes in the V-shaped drainages. There are also areas of gentle slopes consisting of lake sediments of silt and size deposits which have soils that are susceptible to slumpage and creep, especially after cut and fill construction. Severe limitations for sanitary facilities exist in those areas characterized by soil number 2 due to a high volume of large stones greater than 8 cm (3 in) throughout the soil. A high coarse fragment content in those areas characterized by soil number 6 create severe limitations for shallow excavations and sanitary facilities due to the poor filtering capabilities of the substratum. Areas represented by soil number 18 have severe limitations for most management activities due to moderate slopes, a high water table and the slow permeability of the substratum. The presence of a high water table in areas characterized by soil numbers 19 and 20 also create severe limitations for development. Muskeg areas have severe restrictions for management activities due to extreme wetness and deep organic soils.

Alluvial Terrrace Landtype

Map Symbol: 88

Landtype Description:

The Alluvial Terrace landtype of the Glacial Outwash landtype association includes alluvial terraces found at the bottom of glacial U-shaped valleys but above the effects of flooding. These terraces usually have a step-like form. This is the result of being carved by a stream that has undergone a series of fluctuations in size and velocity which corresponded to glacial activity upstream. The Alluvial Terrace landtype may have inclusions which are too small to be mapped separately mapped within it. These inclusions are of the River Cut Sideslope landtypes (84 and 85) where they occupy the steep slopes between the terraces, and of the Low-lying Flood Plain (82) with Unvegetated Stream Channel (83) landtypes where they co-occupy the lowest alluvial terrace.

The Alluvial Terrace landtype is generally found at elevations ranging from sea level to 420 m (1400 ft). Slope gradients are nearly level to gentle (less than 8 percent) except on the river cut sideslopes where gradients are moderate to steep (25 to 70 percent).

Section Differences:

The Alluvial Terrace landtype is not equally distributed between the Resurrection/Six Mile and the Kenai Remnant Glacier sections of the Kenai Peninsula. This landtype is not mapped in the Kenai Remnant Glacier section. The soils and vegetation descriptions given are for the Resurrection/Six Mile section only.

Soils and Vegetation:

The soils of the Alluvial Terrace landtype are formed on deposits of water reworked glacial till and alluvial outwash. These terraces are composed of stratified layers of soil and rocks. The highly variable textures of these layers has resulted in many different soil drainage conditions within the landtype. Approximately 50 percent of the landtype has a mixed vegetative cover of white spruce, black spruce, paper birch and quaking aspen with a thick carpet of lowbush cranberry, crowberry, mosses and lichens. The soils of this area which are represented by soil number 1 are deep and well to somewhat excessively drained. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a loam to fine sandy loam texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles.

About 20 percent of the Alluvial Terrace landtype has a vegetative cover of predominantly black spruce, some white spruce, quaking aspen and paper birch, along with lowbush cranberry, crowberry, lichens and mosses. The soils of this area which are represented by soil number 1 have been described above.

Approximately 10 percent of the landtype occurs in former swales and in areas where slow moving waters have deposited fine sediments. These areas have a thick vegetative cover of white spruce and black cottonwood with devil's club, currant, horestail, bunchberry, grasses and mosses. The soils of this area which are represented by soil number 22 are deep and somewhat poorly drained. The surface soil is a thick mat of highly decomposed organic material. A subsoil is not present here. Beneath the solum the substratum is multiple layers of alluvium which are sorted and stratified by their particle size. These layers are mostly fine textured but range from a loamy sand to a silty clay loam. No coarse fragment were found in any of the layers.

About another 10 percent of the Alluvial Terrace landtype has a vegetative cover of quaking aspen, white spruce and paper birch with crowberry, lowbush cranberry, grasses and mosses. The soils of this area which are represented by soil number 23 are deep and moderately well drained. Above the surface soil is a mat of highly decomposed organic material. The surface soil has a loamy sand texture without any coarse fragments. A subsoil is not present here. Beneath the solum the substratum is multiple layers of alluvium which are sorted and stratified by their particle size. The texture of these layers range from a sand to a fine sandy loam, and the coarse fragment contents range from 0 to 5 percent gravel and from 0 to 30 percent cobbles.

The remaining approximate 10 percent of the landtype is similar to the River Cut Sideslope landtypes (84 and 85) described in this report. The soils of this are which are represented by soil number 1 have been described above.

Management Considerations:

Most of the Alluvial Terrace landtype is suitable for timber management, recreational development and trail and road construction. Sections of the landtype represented by soil number 1 have severe restrictions for excavations and sanitary facilities due to the large volume of coarse fragments in the substratum which make excavations difficult and serve as a poor filtering medium. This section also has a low revegetation potential if cut and filled.

Slow permeability, wetness and low bearing strength on those areas characterized by soil number 22 create severe limitations for recreational development and road construction. Severe restrictions for development also occur on the steep sideslopes between terraces and on the lower terraces adjacent to streams where flooding is a hazard.

Outwash Plain - Forested Landtype

Map Symbol: 89

Landtype Description:

The Forested Outwash Plain landtype of the Glacial Outwash landtype association includes somewhat broad areas of depositional material that are associated with active water channels. Parts of the landtype which are closest to the water may be flooded during exceptionally high flows and receive deposits of alluvium over the surface. Meander scars and remnant channels from former swales are found across the entire landtype surface. Streams have meandered across the outwash plain eroding and depositing sediments. The height of this landtype is often not far above its associate water channel and the water table is usually within 1.5 to 3 m (5 to 10 ft) of the surface for the entire landtype.

The Forested Outwash Plain landtype may have inclusions of the Low-lying Flood Plain (82) and Unvegetated Stream Channel (83) landtypes which are too small to be mapped separately.

The Forested Outwash Plain landtype generally occurs at elevations ranging from 90 to 300 m (300 to 1000 ft). Slope gradients are nearly level (0 to 3 percent).

Section Differences:

The Forested Outwash Plain landtype is not the same on both the Resurrection/Six Mile and the Kenai Remnant Glacier sections of the Kenai Peninsula. The outwash plains are much broader and further developed as a landform in the Kenai Remnant Glacier section. The soils of the landtype are very similar in both sections but the

vegetative cover differs. The vegetation descriptions below are for those areas in the Resurrection/Six Mile section. Vegetative cover on these areas in the Kenai Remnant Glacier section are predominately sitka spruce with some sitka alder. There is less white spruce and black cottonwood.

Soils and Vegetation:

The soils of the Forested Outwash Plain landtype have formed on deposits of alluvium, glacial outwash and reworked till. Approximately 40 percent of the landtype has a dense vegetative cover of black cottonwood and paper birch, some white spruce and willow, with cow parsnip, horsetail, fireweed, forbs and grasses. The soils of this area which are represented by soil number 24 are deep and moderately well drained. The surface soil has a loam texture with 5 percent gravel. A subsoil is not present. Beneath the solum the substratum is multiple layers of alluvium which are sorted and stratified by their particle size. The texture of these layers range from a silty clay loam to a sandy loam. Gravel content ranges from 0 to 5 percent.

About 30 percent of the Forested Outwash Plain landtype has a vegetative cover of white spruce, some cottonwood and paper birch, along with salmonberry, devil's club, bluejoint grass and forbs. The soils of this area which are represented by soil number 25 are deep and somewhat poorly drained. The surface soil is a thick mat of decomposed organic material with a sapric texture and no coarse fragments. A subsoil is not present. Beneath the solum the substratum is layers of alluvium which are roughly sorted and stratified by their particle size. The texture of these layers range from a loamy fine sand to a sand, and the coarse fragment contents range from less than 5 to 70 percent gravel with about 5 percent cobbles.

Approximately 20 percent of the landtype has a vegetative cover of white spruce and black cottonwood with currant, horsetail, ferns and grasses. The soils of this are which are represented by soil number 11 are deep and well drained. The surface soil has a loam texture with about 25 percent gravel. A subsoil is not present. Beneath the solum the substratum is multi-layered. The texture of these layers range from a loam to a coarse sand and the coarse fragment content ranges from 20 to 50 percent gravel and 20 to 30 percent cobbles.

The remaining about 10 percent of the Forested Outwash Plain landtype has a vegetative cover of quaking aspen and white spruce with dwarf birch, labrador tea, crowberry, lowbush cranberry, bunchberry, fireweed and mosses. The soils of this area which are represented by soil number 1 are deep and well drained. The surface soil has a fine sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a loam to fine sandy loam texture with 35 to 45 percent gravel and 10 to 15 percent cobbles. Beneath the solum the substratum has a loamy sand texture with about 45 percent gravel and about 15 percent cobbles.

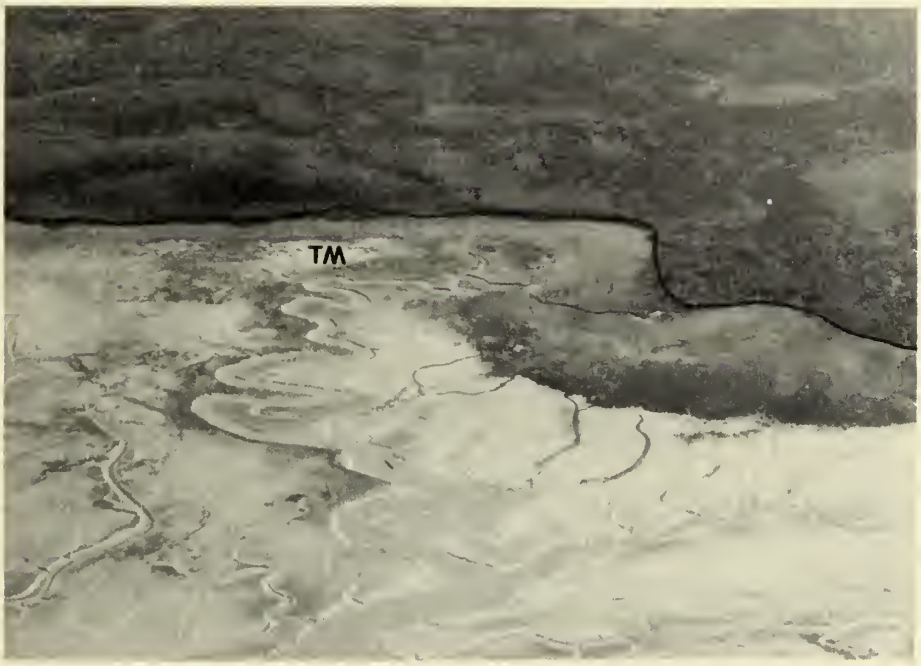
Management Considerations:

Most of the Forested Outwash Plain landtype is very suitable for timber management, recreational development, and trail and road construction. Sections of the landtype represented by soil number 24 have moderate limitations for road construction and septic tank facilities due to its low bearing strength and slow percolation in the substratum. A high coarse fragment content in those areas characterized by soil numbers 1 and 11 create severe restrictions for

shallow excavations, septic tank absorption fields and sanitary landfills because of poor filtering capabilities. Those areas represented by soil number 1 also have a high volume of large stones greater than 8 cm (3 in) in the substratum which create severe restrictions for road construction and shallow excavations. Severe limitations for recreational development and road construction occur in areas represented by soil number 25 due to a high water table and thick accumulations of organic matter at the surface.

TIDAL MARSH LANDTYPE ASSOCIATION

Map Symbol: TM



Association Description:

The Tidal Marsh landtype association is unique to the Kenai Lowlands section of the Chugach National Forest. This association has not been mapped into its component landtypes on the Kenai Peninsula.

The landtype association is characterized by a reticulate pattern of tidal influenced sloughs and very poorly drained fresh water ponds. The landform extends from the ocean inland as far as the salt water goes up the slough channels. The channel banks usually have less than 1.5 m (5 ft) of relief. Slopes are generally less than 6 percent except the channel banks which may be steeper. The dominant vegetation cover on this area may include sedge, grass, vetch and sweetgale with some scattered alder and willow. The density of the alder and willow increases on the slough levees and other areas of relatively better drainage(8).

The only occurrence of the Tidal Marsh landtype association on the Chugach National Forest is an area of about 15 square kilometers (6 square miles) in the northwest corner of the Forest on the Kenai Peninsula. No management activity is planned to be carried out on this area and no typical soils descriptions are given for this area.

Management Considerations:

The Tidal Marsh landtype association is unsuitable for all management activities due to extreme wetness and tidal inundation.

ICE SCOURED LAND LANDTYPE ASSOCIATION

Map Symbol: ISL

Association Description:

The Ice Scoured Land landtype association is common to both the Resurrection/Six Mile and Kenai Remnant Glaciers sections of the Chugach National Forest. Much of this association has been mapped into its component landtypes for high use areas of the Kenai Peninsula.

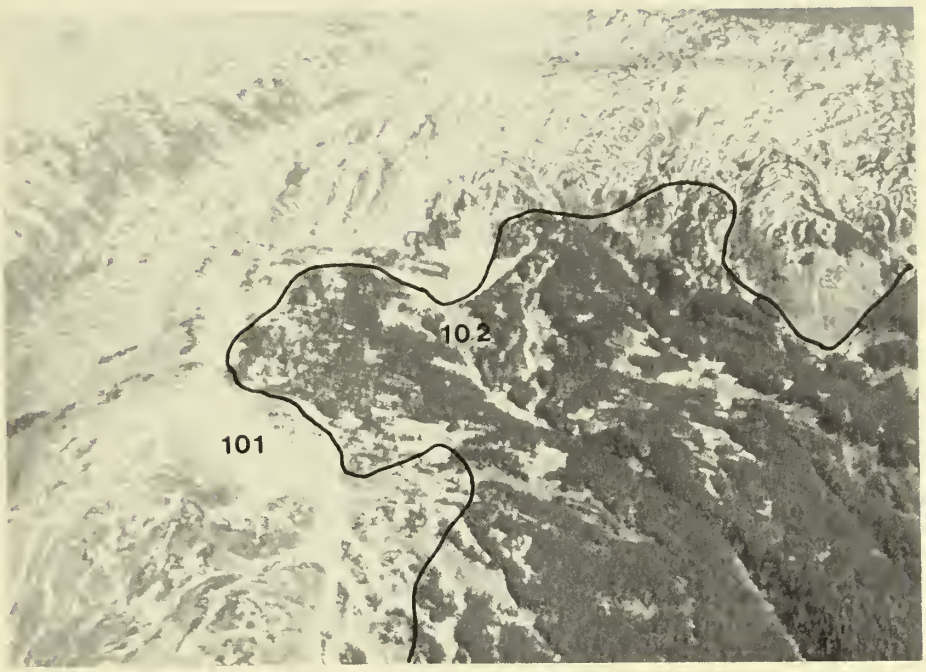
Ice Scoured Land is characterized by an overall parallel alignment of moderate relief hills and valleys. This topography appears to be the result of the scouring action of overriding glaciers or the weathering of variability resistant upturned layers of sedimentary bedrock. The least resistant bedrock has been eroded to form the valleys and the most resistant bedrock remains as the hills. Linear lakes, ponds and muskegs are nested in the low lying valleys. Most slopes range from 21 to 45 percent in gradient and 25 to 100 m (80 to 330 ft) in length. There are some much deeper canyons with near vertical sides that have been cut into weakly resistant bedrock by the larger streams. The vegetation at the lower elevations consists of mountain hemlock with some white spruce in the overstory, and

rusty menziesia, blueberry and bunchberry in the understory. Areas of wetter climate have devil's club and ferns in the understory and typical muskeg vegetation in poorly drained basins. Those areas without an overstory and at higher elevations have a reindeer moss, crowberry, sedge, grass and forb ground cover(8).

The landtypes that are included in the Ice Scoured landtype association are: Ice Scoured Land - Non-forested (101) and Ice Scoured Land - Forested (102).

Ice Scoured Land - Non-forested Landtype

Map Symbol: 101



Landtype Description:

The Non-forested Ice Scoured Land landtype of the Ice Scoured Land landtype association includes higher elevation areas of ice scoured bedrock controlled terrain with less than a 40 percent canopy cover. Small ponds and muskegs can be found in low areas and elongated depressions. This landtype is influenced by frost action and in some areas has pushed up the soil to form small frost heave mounds. Bedrock outcrops are evident over the landtype.

The Non-forested Ice Scoured Land landtype is generally found at elevations ranging from 480 to 760 m (1600 to 2600 ft). Slope gradients are gentle to steep (10 to 65 percent) with slope lengths from 25 to 100 m (80 to 330 ft).

Soils and Vegetation:

The soils of the Non-forested Ice Scoured landtype have formed on glacial till deposits over bedrock, usually less than 50 cm (20 in) deep. Approximately 60 percent of the landtype has an alpine vegetation cover of sparse scattered mountain hemlock, with heather anemone, sandwort, crowberry, gentian, sedge and moss. The soils of

this area which are represented by soil number 26 are well drained and shallow with bedrock within 50 cm (20 in) of the surface. The surface soil has a fine sandy loam texture without any coarse fragments. The subsoil has a sandy loam texture with 15 percent gravel. Beneath the solum the substratum has a coarse sand texture with 55 percent gravel. The soil is over a metasandstone bedrock.

About 15 percent of the Non-forested Ice Scoured landtype has a muskeg vegetative cover of sparse black spruce, some shrub willow, bog blueberry, dwarf birch, and shrubby cinquefoil, with horsetail, five-leaf bramble, crowberry and mosses. The soils of this area which are represented by soil number 27 are a shallow and very poorly drained mat of organic build-up over bedrock with the water table found within 50 cm (20 in) of the surface. The organic surface soil is a peat which has a fibric texture with an extremely high fiber content. The organic subsoil is a muck which has a sapric texture with a moderate fiber content. Beneath the solum there is metasandstone bedrock.

Another approximate 15 percent of the landtype has an alpine vegetative cover similar to that described above but different soils. The soils of this area which are represented by soil number 2 are deep and well drained. The surface soil has a loam texture with about 20 percent gravel and about 20 percent cobbles. The subsoil has a sandy loam texture with 20 to 35 percent gravel and 30 to 35 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 10 percent gravel and about 40 percent cobbles.

The remaining about 10 percent of the Non-forested Ice Scoured landtype consists of exposed rock outcrops with mineral soil and vegetative cover.

Management Considerations:

The Non-forested Ice Scoured landtype has severe restrictions for recreational development and road construction due to the presence of bedrock within 50 cm (20 in) of the surface throughout most of the landtype. Sections of the landtype represented by soil number 26 also have some moderate to extremely steep slopes which severely restrict management activities. Thick accumulations of humus over bedrock create severe limitations for development in those areas represented by soil number 27.

Ice Scoured Land - Forested Landtype

Map Symbol: 102

Landtype Description:

The Forested Ice Scoured Land landtype of the Ice Scoured Land landtype association includes lower elevation areas of ice scoured bedrock controlled terrain with a canopy cover greater than 40 percent. The landtype may also include steep stream cut channels. Ponds and muskegs can be found in the low areas and elongated depressions. Bedrock outcrops may be present over the landtype.

The Forested Ice Scoured landtype generally occurs at elevations ranging from 90 to 480 m (300 to 1600 ft). Slope gradients are gentle to steep (10 to 55 percent) with slope lengths from 25 to 100 m (80 to 330 ft). Steeper slopes (greater than 60 percent) may be along stream cut channels.

Soils and Vegetation:

The soils of the Forested Ice Scoured landtype have formed on glacial till deposits over bedrock, usually greater than 50 cm (20 in) deep. Compact till may be found at 50 to 60 cm (20 to 24 in) of depth. Approximately 60 percent of the landtype has a vegetation cover of mountain hemlock, some white spruce and paper birch, with rusty menziesia, bunchberry, five-leaf bramble, club moss and mosses. The soils of this area which are represented by soil number 6 are deep and well drained. The surface soil has a fine sandy loam texture with about 5 percent gravel. The subsoil has a loamy sand to sandy loam texture with 5 to 15 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 30 to 60 percent gravel and about 5 percent cobbles.

About 10 percent of the Forested Ice Scoured landtype has a vegetative cover of mountain hemlock and white spruce with blueberry, five-leaf bramble and mosses. The soils of this area which are represented by soil number 28 are deep and well drained. Above the surface soil is a thick mat of highly decomposed organic material. The surface soil has a silt loam texture without any coarse fragments. The subsoil has a loamy sand to a sandy loam texture with 10 percent gravel. Beneath the solum the substratum has a sand to very coarse sand texture with 20 to 75 percent gravel.

Another approximate 10 percent of the landtype has a vegetative cover of mixed white spruce, western hemlock and paper birch, with rusty menziesia, dwarf birch, crowberry, lowbush cranberry and mosses. The soils of this area which are represented by soil number 29 are moderately well drained and shallow with bedrock at 44 cm (17 in). Above the surface soil there is a mat of highly decomposed organic material. The surface soil has a loam texture with 10 percent gravel. The subsoil has a sandy loam to coarse sandy loam texture with 10 to 40 percent gravel. Beneath the solum is shale bedrock.

A third about 10 percent of the Forested Ice Scoured landtype has a muskeg vegetation cover of sparce black spruce, some dwarf birch and blueberry, with labrador tea, sphagnum moss and other muskeg plants. The soils of the area which are represented by soil number 33 are a deep and poorly drained build-up of organic material with the water table within 50 cm (20 in) of the surface. The organic surface soil is a peat which has a fibric texture with a very high fiber content. The organic subsoil is a peaty muck to a mucky peat with a moderate fiber content. Beneath the solum the organic substratum is a muck with a low fiber content.

About 5 percent of the landtype has a vegetative cover of white spruce, some mountain hemlock and paper birch, with alder, red elderberry, ferns and grasses. The soils of this area which are represented by soil number 30 are well drained and moderately deep with bedrock at 72 cm (30 in) deep. Above the surface soil is a mat of highly decomposed organic material. The surface soil has a fine sandy loam texture without any coarse fragments. The subsoil has a loamy coarse sand texture with 30 to 50 percent gravel and 10 to 20 percent cobbles. Beneath the solum the substratum has a loamy coarse sand texture with 60 percent gravel and 20 percent cobbles. The soil is over shale bedrock.

The remaining approximate 5 percent of the Forested Ice Scoured landtype consists of exposed rock outcrops with minimal soil and vegetative cover.

Management Considerations:

The Forested Ice Scoured landtype has severe limitations for most management activities due to the moderate to steep slopes and the presence of bedrock within 100 cm (39 ft) of the surface throughout most of the landtype. The low-lying basin areas which are represented by soil number 33 have thick accumulations of organic matter over bedrock whch further restrict its use for development. The steep sloped areas represented by soil numbers 6 and 28 have a high soil creep hazard and a high hazard of surface erosion and slumping if the vegetative cover is removed and the mineral soil is exposed by cut and fill road or trail construction.

BREAKLAND LANDTYPE ASSOCIATION

Map Symbol: BL

Association Description:

The Breaklands landtype association is located only in the Resurrection/Six Mile section of the Chugach National Forest. Much of this association has been mapped into the component landtypes for the high use areas of the Kenai Peninsula.

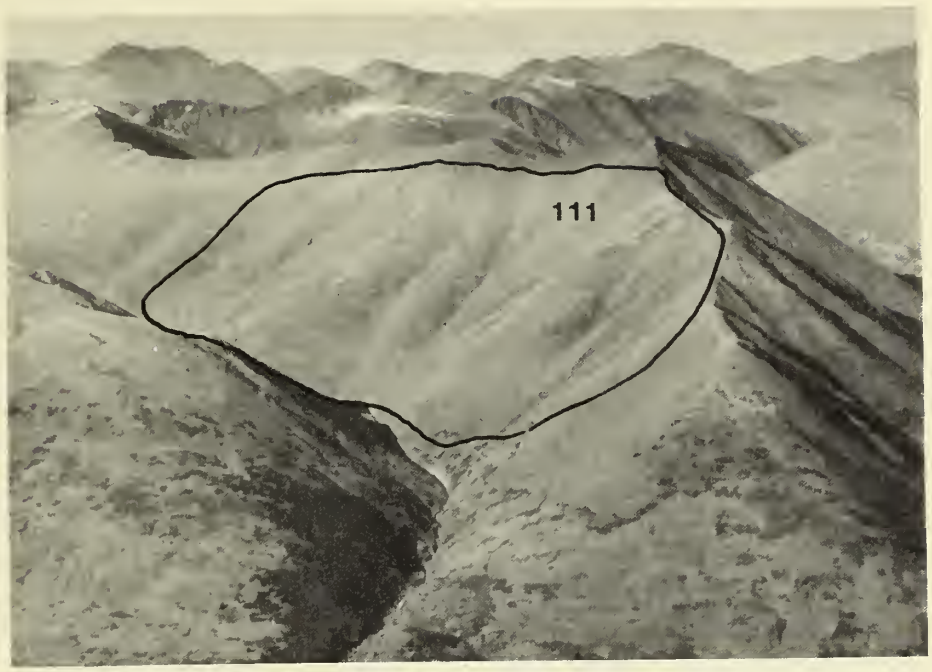
The Breaklands include sideslopes of non-glaciated valleys or glaciated sideslopes between 600 to 1360 m (2000 to 4500 ft) elevation, that are being rejuvinated by active gully erosion. The streams at the base of these slopes are downcutting faster than the upper surfaces can retreat forming V-shaped drainages. This is in contrast to U-shaped glacial drainages. These sideslopes are usually steeper than 60 percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material(13). They are characterized by shallow to deep and sharp to rounded, parallel and/or dendrite V-notches.

Soil and rock creep occur on these sideslopes and provide a continuous source of rock fragments to the stream channels below. The V-notches generally contribute water to the overall hydrologic system during periods of snowmelt or high intensity rain storms. The vegetation consists mostly of crowberry, bluegrass, and bluejoint grass in the open areas, some willow and alder in the drainages, and spots of mountain hemlock on the smooth and unbroken lower to middle slopes.

The landtypes that are included in the Breakland landtype association are: Early Stage Breakland (111), Mid-stage Breakland (112), Late Stage Breakland (113), and Headlands (114).

Early Stage Breakland Landtype

Map Symbol 111



Landtype Description: The Early Stage Breaklands landtype of the Breakland landtype association includes V-shaped drainages between 600 to 1360 m (2000 to 4500 ft) elevation, where the smooth sideslopes are being rejuvenated by the active downcutting of the major streams. These slopes are steepening at a rate faster than they can retreat. The slopes are steeper than 45 percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material. Soil and rock creep occur on these slopes and provide a continuous source of rock fragments and soil to the stream channels below. Most of the slopes are cut by widely spaced, shallow and rounded V-notches which form a parallel drainage pattern. These V-notches carry surface water only during the most rapid runoff periods and highest intensity rain storms. It is felt that more water penetrates through the soil than runs off on the surface on this landtype.

Soils and Vegetation: The soils of the Early Stage Breakland landtype have formed on accumulations of soil and rock which are mostly the result of on site activity with some accumulations on lower slopes. Approximately 75 percent of the landtype occurs mostly on the smooth, slightly broken and lower slopes with an open vegetative cover of spirea, shrub willow and some low juniper along with fireweed, oakfern, bluejoint grass, sedge, crowberry, and other low grasses and mosses. The soils of this area which are represented by soil number 31 are well to somewhat excessively drained and moderate to deep with bedrock found at about 101 cm (40 in). The surface soil has a silt loam texture

with up to about 15 percent gravel. The subsoil has a loamy sand to silt loam texture with 25 to 45 percent gravel and about 15 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 35 percent gravel and about 40 percent cobbles. The soil is over a slate, shale and/or metasandstone bedrock.

About 10 percent of the landtype also occurs mostly on the smooth, slightly broken and lower slopes with a dense vegetation cover of mountain hemlock, oak fern and fireweed, with spirea, lupine, five-leaf bramble, bluegrass and clubmoss. The soils of this area which are represented by soil number 11 are deep and well drained. The surface soil has a fine sandy loam texture with less than 5 to 55 percent gravel and up to about 10 percent cobbles. A subsoil is not present. Beneath the solum the substratum is layered. The texture of these layers range from a fine sandy loam to a coarse sand and the coarse fragment contents range from 30 to 90 percent gravel and 5 to 15 percent cobbles.

The remaining approximate 15 percent of the Early Stage Breakland landtype occurs mostly on the lower slopes with a dense vegetative cover of shrub alder with some fireweed, oakfern, wood fern, bluejoint grass and moss. The soils of this area which are represented by soil number 2 are deep and well drained. Above the surface soil there is a build-up of organic material. The surface soil has a silt loam texture with about 5 percent gravel and about 5 percent cobbles. The subsoil has a silt loam texture with 35 to 65 percent gravel and about 5 percent cobbles. Beneath the solum the substratum has a sand texture with about 80 percent gravel and about 10 percent cobbles.

Management Considerations:

The Early Stage Breakland landtype has severe restrictions for most management activities due to extremely steep slopes. Most of the landtype has a very high soil creep hazard, a high to very high avalanche hazard, and a high surface erosion hazard if the vegetative cover is removed and mineral soil is exposed. This landtype has a very high surface erosion hazard and a moderate to very high slump hazard if cut and filled for road or trail construction.

Mid-stage Breakland Landtype

Map Symbol 112

Landtype Description: The Mid-stage Breakland landtype of the Breakland landtype association includes V-shaped drainages between 600 to 1360 m (2000 to 4500 ft) elevation, where the smooth sideslopes are being rejuvenated by the active downcutting of the major streams. These slopes are steepening at a rate faster than they can retreat. The slopes are steeper than 50 percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material. Soil and rock creep occur on these slopes and provide a continuous source of rock fragments and soil to the stream channels below. Most of these slopes are cut by moderately spaced sharp and rounded, moderately deep V-notches which form a parallel or a dendritic drainage pattern. These V-notches which are commonly eroded into bedrock carry water during snow melt runoff and rainstorms. It is felt that the portion of the runoff water which enters the soil is about equal to that which flows on the surface.

Soils and Vegetation: The soils of the Mid-stage Breakland landtype have formed on accumulations of soil and rock which are mostly the result of on site weathering activity with some accumulations on the lower slopes. Approximately 60 percent of the landtype occurs mostly on the smooth, slightly broken and midslopes with an open vegetative cover of shrub willow and labrador tea, with some crowberry, alpine bearberry, anemone, heather, reindeer moss, grass and mosses. The soils of this area which are represented by soil number 2 are well drained and moderately deep with bedrock at about 65 cm (26 in). Above the

mineral surface soil there is a mat of organic material. The surface soil has a silt loam texture with about 40 percent gravel and about 10 percent cobbles. The subsoil has a loamy sand texture with about 70 percent gravel and about 15 percent cobbles. Beneath the solum the substratum has a loam texture with about 60 percent gravel and about 20 percent cobbles. The soil is over a slate, shale and/or metasandstone bedrock.

About 25 percent of the landtype occurs mostly on the lower slopes with an open vegetative cover of shrub willow with bluejoint grass, fireweed, oak ferns and moss. The soils of this area which are represented by soil number 31 are well to somewhat excessively drained and moderate to deep with bedrock found at about 101 cm (40 in). The surface soil has a silt loam texture with up to about 15 percent gravel. The subsoil has a loamy sand to silt loam texture with 25 to 45 percent gravel and about 15 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 35 percent gravel and about 40 percent cobbles. The soil is over a slate, shale and/or metasandstone bedrock.

Approximately 10 percent of the Mid-stage Breakland landtype occurs mostly on the higher elevation rocky areas with an alpine type vegetative cover of alpine bearberry, anemone, heather, crowberry, moss and grass. The soils of this area which are represented by soil number 32 are well drained and shallow with bedrock at about 49 cm (19 in). The surface soil has a loam texture with about 40 percent gravel and about 15 percent cobbles. The subsoil has a loam texture with about 45 percent gravel and about 10 percent cobbles. Beneath the solum the substratum has a loam texture with about 45 percent gravel and about 10 percent cobbles. The soil is over a slate and/or metasandstone bedrock.

The remaining approximate 5 percent of the Mid-stage Breakland landtype is exposed bedrock outcrops with little soil and vegetative cover and is associated with the higher elevation slopes and V-notch drainages.

Management Considerations:

The Mid-stage Breakland landtype has severe restrictions for most management activities due to extremely steep slopes. There is a high to very high avalanche hazard and soil creep hazard throughout most of the landtype. A high to very high surface erosion hazard exists if the vegetative cover is removed and mineral soil is exposed. This landtype also has a high to very high surface erosion hazard and slump hazard if cut and filled for trail or road construction. Areas represented by soil numbers 2 and 32 have a low natural vegetation potential if cut and filled.

Late Stage Breakland Landtype

Map Symbol: 113

Landtype Description: The Late Stage Breakland landtype of the Breakland landtype association includes V-shaped drainages betweem 600 to 1360 m (2000 to 4500 ft) elevation, where the smooth sideslopes are being rejuvenated by the active downcutting of the major streams. These slopes are steepening at a rate faster than they can retreat. The slopes are usually steeper than 60 percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material. Soil and rock creep occur on these slopes and provide a continuous source of rock fragments and soil to the stream channels below. These slopes are cut by closely spaced, sharp and deep V-notches which form a predominantly dendritic drainage. These V-notches have generally eroded to bedrock and carry water during the majority of snow melt runoff events and/or rainstorms. It is felt that the greater portion of the water flows over the soil surface rather than in the soil. Much of the landtype has exposed bedrock.

Soils and Vegetation: The soils of the Late Stage Breakland landtype have formed on accumulation of soil and rock which are mostly the result of on site weathering activity with some accumulations on the lower slopes. Approximately 45 percent of the landtype occurs mostly on the middle and lower slopes with a vegetative cover of crowberry, lowbush cranberry, low juniper and shrub willow, with alpine saxifrage, alpine azalea, dwarf fireweed, grass and lichens. The soils of this area which are represented by soil number 31 are well to somewhat excessively drained and moderate to deep with bedrock found at about

101 cm (40 in). The surface soil has a silt loam texture with up to about 15 percent gravel. The subsoil has a loamy to silt loam texture with 25 to 45 percent gravel and about 15 percent cobbles. Beneath the solum the substratum has a sandy loam texture with about 35 percent gravel and about 40 percent cobbles. The soil is over a slate, shale and/or metasandstone bedrock.

About 35 percent of the landtype occurs mostly on the higher elevation slopes with an alpine type vegetation cover of alpine bearberry, anemone, alpine saxifrage, dwarf fireweed, alpine azalea, grass and lichens. The soils of this area which are represented by soil number 32 are well drained and shallow with bedrock at 49 cm (19 in). The surface soil has a loam texture with about 40 percent gravel and about 15 percent cobbles. The subsoil has a loam texture with about 45 percent gravel and about 10 percent cobbles. Beneath the solum the substratum has a loam texture with about 45 percent gravel and about 10 percent cobbles. The soil is over slate and/or metasandstone bedrock.

The remaining approximate 20 percent of the Late Stage Breakland landtype is exposed bedrock outcrops with little soil and vegetative cover and is associated with the higher elevation slopes and V-notch drainages.

Management Considerations:

The Late Stage Breakland landtype has severe limitations for most management activities due to extremely steep slopes and a very high avalanche hazard. There is a very high soil creep hazard and a moderate to very high surface erosion hazard if the vegetative cover is removed and mineral soil is exposed. A high to very high surface erosion and slump hazard exists if the soils are cut and filled for trail or road construction. Areas represented by soil number 2 also have a low natural revegetation potential if cut and filled.

Headland Landtype

Map Symbol: 114

Landtype Description: The Headlands landtype of the Breakland landtype association includes areas at the head of V-shaped valleys between 600 to 1360 m (2000 to 4500 ft) elevation, where the sideslopes are being rejuvenated by the active downcutting of the major streams. These slopes are steepening at a rate faster than they can retreat. The slopes are usually steeper than 45 percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material. Soil and rock creep occur on these slopes and provide a continuous source of rock fragments and soil to the stream channels below. These slopes are cut by rounded to sharp and shallow to deep V-notches which coverage at the bottom of the landtype. The surface water provided by snowmelt runoff and rainstorms flows down these V-notches and upon convergence the flow and energy are drastically intensified. This provides the water energy necessary for downcutting of the stream channel with near vertical sideslopes downstream.

Soils and Vegetation: The soils of the Headland landtype have formed on accumulations of soil and rock which are mostly the result of on site weathering activity. Approximately 80 percent of the landtype occurs mostly on the smooth and slightly broken slopes with a vegetative cover of shrub willow, rusty menziesia, dwarf birch and mountain hemlock, with crowberry, fireweed, five-leaf bramble, luetkea, bluejoint grass, sedge, and other grasses and moss. The soils of this area which are represented by soil number 1 are moderately deep to deep and well drained. Above the surface soil is a thick mat of organic material.

The surface soil has a sandy loam texture with about 10 percent gravel and about 5 percent cobbles. The subsoil has a sandy loam texture with about 25 percent gravel and about 10 percent cobbles. Beneath the solum the substratum has a coarse sand texture with 35 to 40 percent gravel and 15 to 25 percent cobbles.

About 15 percent of the landtype occurs mostly on the upper slopes with a vegetative cover of crowberry, shrub willow, and alpine bearberry, with dwarf fireweed, alpine saxifrage, grasses and moss. The soils of this area which are represented by soil number 32 are well drained and shallow with bedrock at 49 cm (19 in). The surface soil has a loam texture with about 40 percent gravel and about 15 percent cobbles. The subsoil has a loam texture with about 45 percent gravel and about 10 percent cobbles. Beneath the solum the substratum has a loam texture with about 45 percent gravel and about 10 percent cobbles. The soil is over a slate and/or metasandstone bedrock.

The remaining approximate 5 percent of the Headland landtype is exposed bedrock outcrops with little soil and vegetative cover, and is associated with the higher elevation slopes and V-notch drainages.

Management Considerations:

The Headlands landtype has severe limitations for most management activities due to steep slopes and a very high avalanche hazard. The areas represented by soil number 32 have a very high soil creep hazard, a very high surface erosion hazard if the vegetative cover is removed and a very high surface erosion and high slump hazard if the soil is cut and filled for trail or road construction. There is also a very low revegetation potential if this landtype is cut and filled.

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APPENDIX A

SITE CHARACTERISTICS

Map Symbol and Description. The identifying map symbol and description title for each landtype and landtype association (mapping unit) are stated.

Soil Number and Percent of Unit. The number assigned to each soil family and the percentage of that soil within each mapping unit is stated. The letter "R" represents exposed rock and talus.

Soil and Hydrologic Properties

Soil Depth. The soil depth is the dominant depth range of each soil from the surface to bedrock. The depth classes are:

Class	Soil Depth (cm)	(in)
S	Shallow-less than 50	(<20)
M	Moderate-50 to 100	(20-39)
D	Deep - greater than 100	(>39)

Slope Gradients. The slope gradient is the overall range of slopes observed in the field for each soil family mapped. The slope classes are:

Class	Slope Gradient (%)
A	0 to 8
B	9 to 15
C	16 to 25
D	26 to 45
E	46 to 65
F	greater than 66

Drainage. The general relative soil drainage class is based upon field observations and inferences related to runoff, soil permeability, and internal soil drainage. The drainage class reflects the degree of aeration within the soil profile which is affected by slope, soil structure, soil texture, the volume of coarse fragments and the presence or lack of an impermeable layer of bedrock near the soil surface. The drainage classes are as follows:

Class	Soil Drainage Class
VPD	Very poorly drained
PD	Poorly drained
SPD	Somewhat poorly drained
MWD	Moderately well drained
WD	Well drained
SED	Somewhat excessively drained
ED	Excessively drained

See GLOSSARY - Soil Drainage for an explanation of the soil drainage classes.

Infiltration. Infiltration is the rate of which water enters the soil. The infiltration rate of a soil is controlled by the structure, porosity, organic matter content, and texture of the surface layers. The soil infiltration classes are:

Class	Infiltration and Permeability-Rate (mm/hr)	(in/hr)
VS	Very Slow - less than 5	(<0.2)
S	Slow - 5 to 15	(0.2-0.6)
M	Moderate - 15 to 51	(0.6-2.0)
R	Rapid - 51 to 152	(2.0-6.0)
VR	Very Rapid - greater than 152	(>6.0)

Permeability. Permeability of percolation is the rate at which water moves through the soil. It is determined by the structure and texture of the soil profile below the surface layers. The same five classes are used for permeability as are used for infiltration.

Geology

Rocktype and/or Surfical Deposits. The rocktype identifies the type of bedrock found within the mapping unit. Separations are made between rocks of sedimentary and metamorphic orgin.

Class	Rocktype	Includes
S	Sedimentary -	sandstone, graywacke, shale, conglomerate, limestone, siltstone
M	Metamorphic -	slate, metasandstone, argilite, quartzite

The surfical deposits identifies the type of soil material deposit found within the mapping unit. Separations are made between glacial till and stream alluvium deposits.

Class	Surfical Deposit	Includes
T	Till	compact and reworked till
A	Alluvium	alluvial and alluvial/colluvial

Weathering. The weathering of bedrock is a measure of the physical and chemical changes produced at or near the earth's surface by atmospheric agents. These changes result in desintegration and decomposition of the material. The weathering classes for the rocktypes are:

Class	Weathering Key for Sedimentary and Metamorphic Rocks
1	Very hard unweathered - will ring to hammer blow. Cannot be dug with point of a rock hammer. No visible color changes.
2	Hard, weakly weathered - similar to above but has weathering signs such as color changes.
3	Moderately weathered - gives a dull ring to hammer. No root penetration.
4	Transitional - may be broken by blow with a hammer. No ring or dull ring with hammer. Cannot be broken in hands.
5	Moderately well weathered - rock will break into peds with bare hands under moderate pressure. Root penetration between peds.
6	Well weathered - rock will crumble under moderate pressure with bare hands. Roots can penetrate between all surfaces.

7 Highly weathered - minerals have weathered to clay and rock is plastic when wet. No resistance to root penetration.

Fracturing. The fracturing of bedrock is a measure of the distance between natural fractures, fissures, and/or planes of weakness. The fracturing classes are:

Class	Fracturing Frequency Distance (m)	(ft)
M	Massive - greater than 1.8	(>6)
SF	Slightly Fractured - 1.2 to 1.8	(4-6)
MF	Moderately Fractured - 0.5 to 1.2	(1.5-4)
WF	Well Fractured - 0.2 to 0.5	(0.5-1.5)
EF	Extremely Fractured - less than 0.2	(<0.5)

Vegetation

Major Vegetation Type. The major vegetation type is listed according to the dominant overstory, shrub and/or forb species present.

TABLE I

SITE CHARACTERISTICS

Map Symbol	Description	Soil Number	% of Unit	Soil Depth	Slope Gradient	Drainage	Infiltration	Permeability
					Soil and Hydrology Properties			
AH	Alpine Highland	R	90	S	E-F	NA	NA	NA
		1	10	M-D	C-F	WD	R	M
FCH	Frost Churned Highland	2	75	M-D	D-E	WD	R	M
		R	25	S	E-F	NA	NA	NA
GS	Glacial Sideslope							
31	Forested Upper Sideslope	3	50	D	E	WD	R	M
		4	30	S	E	SED	R	M
		2	10	D	F	MWD	M	M
		5	10	D	E	PD	R	M
32	Non-forested Upper Sideslope	1	50	D	D-E	WD	R	M-R
		2	20	M-D	E-F	WD	M-R	M
		2	15	M	E-F	WD	M-R	M-R
		5	10	D	E	PD	R	M
		2	5	D	D-E	WD	M	M
33	Forested Concave Lower Sideslope	6	50	D	D	WD	R	M
		7	20	D	C	MWD	R	S
		1	15	D	B-D	WD-MWD	M-R	M-R
		8	10	D	C-D	MWD-WD	R	S
		5	5	D	B-C	PD	R	M
34	Non-forested Concave Lower Sideslope	9	30	D	C-D	WD	R-M	R-M
		9	30	D	C-D	WD	R	M
		6	20	D	B-D	WD	R	M
		10	20	D	C	MWD	R	S
35	Scree Fan	11	65	D	B-D	WD	R	M
		12	30	D	E	WD	R	R
		6	5	D	D	WD	R	M
IS	Ice and Snow	-	100	-	-	-	-	-
GM	Glacial Moraine							
71	Low Relief Moraine	1	90	D	A-D	WD	R	M-R
		14	10	D	A	PD	R	M
72	High Relief Moraine	2	70	D	A-C	WD	R	M-S
		6	15	D	A-C	WD	R	M-R
		5	15	D	A	VPD-PD	R	S-VS

*NA - Not Applicable

TABLE I

SITE CHARACTERISTICS

Geology			Vegetation
Rocktype and/or Surfical Deposits	Weathering	Fracturing	Major Vegetation Type
S,M	1-3	MF-EF	Not vegetated Alpine vegetation
S,M	3	MF-EF	Alpine vegetation Not vegetated
S,M,T	2-3	WF-EF	Mt. hemlock, menziesia, blueberry Mt. hemlock, menziesia, blueberry Alder, grass Alder, devil's club, ferns, grass
S,M,T	2-4	M-MF	Alder, spirea, grass Grass, fireweed Alpine vegetation Alder, devil's club, ferns Mt. hemlock, blueberry,ferns, moss
S,M,T	2-3	WF-EF	Mt. hemlock, menziesia, spruce Alder, elderberry, grass Spruce, hemlock, birch Willow, grass Spruce, alder, crowberry
S,M,T	2-3	WF-EF	Grass, spirea, menziesia Alder, salmonberry, elderberry Hemlock, spruce, willow, grass Alder, ferns, moss
S,M,A	2-3	WF-EF	Alder, ferns, grass Grass, sedge, birch Mt. hemlock, alder, grass
-	-	-	Not vegetated
T,A	NA	NA	Leutkea, willow, hemlock Willow, birch, grass, sedge
S,M,T	1-2	EF	Spruce, hemlock, birch Grass, alder, hemlock, menziesia Muskeg vegetation

TABLE I

SITE CHARACTERISTICS

Map Symbol	Description	Soil Number	% of Unit	Soil Depth	Slope Gradient	Drainage	Infiltration	Permeability
					Soil and Hydrology Properties			
GO	Glacial Outwash							
81	Alluvial Fan	11	60	D	A	SED-MWD	R-M	R-M
		12	20	D	A	WD	R	R
		13	10	D	A	MWD	M	R
		1	10	D	A	WD-MWD	R	M
82	Low-lying Flood Plain	14	70	D	A	PD	R	M
		11	30	D	A	WD	M	R
83	Stream Channel	14	100	D	A	PD	R	R
84	Alluvium and Till River Sideslope	11	75	D	E-F	WD-SED	R-M	M-R
		4	10	S	E	WD	R	M-R
		6	10	D	F	WD	R	M
		11	5	D	F	SED	R	R
85	Bedrock River Sideslope	6	40	D	E-F	WD-SED	R	R
		4	20	S	E	WD	R	M-R
		15	20	S	E-F	SPD	R	M
		R	20	NA	E-F	NA	NA	NA
86	High Elevation Valley Train	16	50	D	A-B	PD-SPD	R-M	S-M
		2	40	D	A-B	WD-MWD	R	M
		17	10	D	A	PD	R	S
87	Alluvial and Till Bench	2	35	D	A-C	WD	R	R-M
		6	30	D	A-D	WD-SED	R	M
		18	15	D	B	SPD	M	S
		19	10	D	A-C	MWD-SPD	M-R	M-S
		20	5	D	B	SPD	R	S
		21	5	D	B	PD	R	R
88	Alluvial Terrace	1	50	D	A	WD-SED	R	M-R
		1	20	D	A	WD	R	M
		22	10	D	A	SPD	R	S
		23	10	D	A	MWD-WD	R	M
		1	10	D	E	WD	M	R
89	Forested Outwash Plain	24	40	D	A	MWD	R	S-R
		25	30	D	A	SPD	R	R
		11	20	D	A	WD-MWD	M-R	R-M
		1	10	D	A	SED	R	R-M

TABLE I

SITE CHARACTERISTICS

Geology			Vegetation
Rocktype and/or Surfical Deposits	Weathering	Fracturing	Major Vegetation Type
S,M,T	2-3	WF-EF	Spruce, cottonwood
F			Cottonwood, alder, spruce, devil's club
R			Willow, spruce, alder, ferns
M			Spruce, willow, birch, fireweed
A	NA	NA	Willow, alder, birch, grass
			Alder, birch, spruce, fireweed
A	NA	NA	Willow, alder, fireweed, grass
S,M,A,T	2-3	MF-EF	Spruce, birch, alder, menziesia
			Spruce, birch, cottonwood, alder
			Alder, grass, willow
			Not vegetated
S,M,T	2-5	MF-EF	Birch, hemlock, spruce, menziesia
			Spruce, birch, cottonwood, alder
			Alder, grass, ferns, elderberry
			Not vegetated
S,M,T,A	3-4	EF	Willow, sedge, crowberry, grass
			Grass, sedge, crowberry
			Grass, sedge, sphagnum, blueberry
S,M,A,T	2	EF	Spruce, hemlock, grass, fireweed
			Spruce, hemlock, aspen, willow
			Alder, currant, moss, grass
			Willow, alder, grass, blueberry
			Alder, menziesia, blueberry, horsetail
			Moss, black spruce, alder, birch
A	NA	NA	Spruce, birch, aspen, cranberry
			Black spruce, cranberry, crowberry
			Spruce, cottonwood, devil's club, horsetail
			Spruce, birch, aspen, cranberry, grass
			Spruce, birch, menziesia, grass
A-T	NA	NA	Cottonwood, spruce, birch, grass
			Spruce, cottonwood, birch, grass
			Spruce, cottonwood, grass, moss
			Aspen, spruce, birch, grass, moss

TABLE I

SITE CHARACTERISTICS

Map Symbol	Description	Soil Number	% of Unit	Soil Depth	Soil and Hydrology Properties: Slope Gradient	Drainage	Infiltration	Permeability
TM	Tidal Marsh	-	-	D	A	VPD-SPD	-	-
ISL	Ice Scoured Land							
101	Non-forested Ice Scoured Land	26	60	S	B-E	WD	R	S-M
		27	15	S	A	VPD	R	VS
		2	15	D	B-C	WD-MWD	M	S
		R	10	NA	A-D	NA	NA	NA
102	Forested Ice Scoured Land	6	60	D	B-E	WD	R	M
		28	10	D	E	WD	R	M
		29	10	S	A-D	MWD-WD	R-M	M
		33	10	D	A	PD-VPD	R	S-R
		30	5	M	A-D	WD-MWD	R	R-M
		R	5	NA	D-F	NA	NA	NA
BL	Breakland							
111	Early Stage Breakland	31	75	D	E-F	WD-SED	M-R	R
		11	10	D	D-E	WD	M	R
		2	15	D	E-F	WD	M	R
112	Mid-stage Breakland	2	60	M	F	WD	R	R
		31	25	M-D	E-F	WD-SED	M-R	R
		32	10	S	E-F	WD	R	R
		R	5	NA	E-F	NA	NA	NA
113	Late Stage Breakland	31	45	M-D	E-F	WD-SED	M-R	R
		32	35	S	E-F	WD	R	R
		R	20	NA	F	NA	NA	NA
114	Headland	1	80	M-D	D-E	WD	R	R
		32	15	S	E-F	WD	R	R
		R	5	NA	E-F	NA	NA	NA

TABLE I

SITE CHARACTERISTICS

Geology			Vegetation
Rocktype and/or Surfical Deposits	Weathering	Fracturing	Major Vegetation Type
-	-	-	Sedge, grass, alder, willow
S,M,T	2	M-EF	Mt. hemlock, alpine vegetation Black spruce, willow, muskeg vegetation Blueberry, alpine vegetation Not vegetated
M,S,T	2-5	M-EF	Mt. hemlock, menziesia, spruce, bunchberry Mt. hemlock, spruce, blueberry, 5-leaf bramble Mt. hemlock, spruce, birch, menziesia Muskeg vegetation Spruce, hemlock, blueberry, sphagnum Not vegetated
S,M	2-3	MF-EF	Spirea, willow, juniper, alpine vegetation Mt. hemlock, fern, fireweed Alder, fireweed, fern, grass
S,M	2-3	MF-EF	Willow, labrador tea, grass, alpine vegetation Willow, grass, fireweed, fern Alpine vegetation Not vegetated
S,M	2-4	MF-EF	Crowberry, cranberry, juniper, willow, alpine plants Alpine vegetation Not vegetated
S,M	2-4	MF-EF	Willow, menziesia, birch, crowberry, Mt. hemlock Crowberry, willow, grass, alpine plants Not vegetated

APPENDIX B

HAZARD RATINGS

Map Symbol and Description. The identifying map symbol and description title for each landtype and landtype association (mapping unit) are stated.

Soil Number and Percent of Unit. The number assigned to each soil family and the percentage of that soil within each mapping unit is stated. The letter "R" represents exposed rock and talus.

Erosion

Surface Erosion. The inherent surface erosion hazard is rated for bare soil conditions according to five classes. These classes are based on the ability of the soil to take in water, resistance of the soil surface to dispersion under the impact of rainfall and surface water movement. The factors considered were soil erodibility as a result of soil texture, and the volume of coarse fragments which reduces the detatchment of surface soil. Climate and topography are also factors considered in the ratings. The surface erosion hazard classes are:

Class	Surface Erosion
VH	Very High - Unprotected bare soil will erode sufficiently to severly and permanently damage the productive capacity of the soil or will yield excessively high volumes of sediment.
H	High - Unprotected bare soil will erode sufficiently to severely damage productive capacity or will yield high volume of sediment.
M	Moderate - Sufficiently resistant to erosion to permit limited and temporary exposure to bare soil during development or use.
L	Low - Sufficiently resistant to erosion to permit exposure of bare soil under minimal precautionary restrictions.
VL	Very Low - No appreciable hazard of erosion.

Surface Erosion - Cut and Fill. The surface erosion hazard for cut and fill slopes is rated for bare soil conditions according to five classes. It is based on a standard road of cut and fill design with a 3.5 m (12 ft) insloped driving surface, a 1 m (3 ft) outside berm and a 1 m (3 ft) inside ditch. The cut and fills are assumed to have balanced slope heights and ratios as required to construct the 5.5 m (18 ft) wide road prism on the dominant slope gradient of the designated area. All fill slopes are assumed to be uncompacted and cut and fill slopes are assumed unvegetated. The criteria considered in the development of the classes were all of the factors for surface erosion. The cut and fill surface erosion hazard classes are:

Class	Erosion - Cut and Fill
VH	Very High - Unprotected cuts and fills will yield excessively high volumes of sediments.

H High - Unprotected cuts and fills will yield excessively high volumes of sediment during periods of flashy or long duration runoff.

M Moderate - Sufficiently resistant to erosion to permit temporary exposure of bare soil after construction.

L Low - Sufficiently resistant to erosion to permit exposure of bare soil under minimal precautionary restrictions.

VL Very Low - No appreciable erosion hazard.

Restoration

Reforestation Potential. The inherent potential for natural reforestation of sites is rated according to five classes. Criteria considered in the development of these classes were vegetative competition, climatic restrictions and exposure, the water holding capacity of the soil, soil depth, texture, drainage and fertility, and the proximity of a seed source. The degree of stocked tree stands are defined as well (greater than 70% stocked), adequate (40 to 70% stocked), poor (10 to 40% stocked), and non-stocked (less than 10% stocked). The reforestation potential classes are:

Class	Reforestation Potential
VH	Very High - Excellent response to natural reforestation can be expected within the first five years after the timber sale without site preparation. Artificial regeneration should not be necessary for a well stocked tree stand. (>70%)
H	High - Good response to natural reforestation to produce an adequately stocked stand can be expected within the first five years after timber sale without site preparation. Artificial regeneration or site preparation will be necessary to produce a well stocked tree stand. (>70%)
M	Moderate - Fair response to natural reforestation can be expected within the first five years after the timber sale without site preparation. Artificial regeneration and site preparation will be necessary to produce an adequately stocked tree stand. (40-70%)
L	Low - Poor natural reforestation can be expected after the timber sale. Artificial regeneration and extensive site preparation will be necessary to produce an adequately stocked tree stand. (40-70%)
VL	Very Low - Little or no natural reforestation can be expected after the timber sale. An adequate stock stand will be difficult to obtain even after site preparation and artificial regeneration. (< 40%)

Revegetation Potential - Cut and Fill. The potential for natural revegetation of cut and fill slopes is rated according to five classes. Criteria considered in the development of these classes were all of the factors for reforestation potential except vegetative competition and possibly avalanche hazard. Additional criteria are surface erosion of the cut and fill slopes. Specialized revegetation practices such as hydro-seeding or the use of erosion control mats

are not considered in this category. The revegetation potential classes for cut and fill slopes are:

Class	Cut and Fill Revegetation Potential
VH	Very High - Excellent response to revegetation can be expected the first year with normally accepted practices. The mineral soil has a very low erosion hazard.
H	High - Good response to revegetation can be expected the first year with normally accepted practices. The mineral soil has a low erosion hazard.
M	Moderate - Fair response to revegetation can be expected the first year with normal practices. More than one year may be necessary to establish a protective vegetated cover. Limitations are soil properties and/or somewhat adverse climatic conditions. The mineral soil has a moderate erosion hazard.
L	Low - Poor response can be expected the first year by using normal revegetation practices. Limitations are coarse textures, high erosion rate, low fertility level, or averse climatic conditions. The mineral soil has a high erosion hazard.
VL	Very Low - Little or no response can be expected the first year by using normal revegetation practices. Limitations are very coarse textured soils, a very high erosion rate, low fertility level, or adverse climatic conditions. The mineral soil has a very high erosion hazard.

Slope Stability

Avalanche. The avalanche hazard is rated for areas according to five classes. These classes are based on the distance between observed or suspected avalanche paths as evidenced by vegetation patterns, aerial photography taken at the appropriate time of the year, or observance of snow and debris remaining on the ground at the time the evaluation is made. The avalanche hazard classes are:

Class	Avalanche Hazard Spacing (m)	(ft)
VH	Very high - 0 to 300	0 to 1000
H	High - 300 to 600	1000 to 2000
M	Moderate - 600 to 900	2000 to 3000
L	Low - 900 to 1500	3000 to 5000
VL	Very low - greater than 1500	greater than 5000

Soil Creep. The soil creep hazard is rated for areas according to five relative classes for wet and dry creep and involves the long-term movement of material downslope. It accounts for the largest proportion of mass wasting and results in the accumulation of materials which under the proper climatic and soil moisture conditions may become a debris slide. The criteria considered in the development of the classes were slope, frequent freeze-thaw and/or wetting-drying, strength of vegetation roots, and soil depth, moisture and cohesiveness. The soil creep hazard classes are:

Class	Soil Creep Hazard
VH	Very high
H	High
M	Moderate
L	Low
VL	Very low

Debris Slide. The debris slide hazard refers to the failure of accumulations of material in a rolling and sliding motion and is rated for areas according to five classes. (The material is unsaturated in a debris slide and saturated in a debris flow.) The criteria considered in the development of the classes were slope, soil texture, vegetation and rooting strength, the presence of impermeable subsurface layers and/or unconsolidated, cohesionless soils and the evidence of soil creep. The debris slide hazard classes are:

Class	Debris Slide and Slump Hazard
VH	Very High - 6 or more actual and/or potential per 300 m (1000 ft) of slope.
H	High - 4 to 6 actual and/or potential per 300 m (1000 ft) of slope.
M	Moderate - 3 to 4 actual and/or potential per 300 m (1000 ft) of slope.
L	Low - 2 to 3 actual and/or potential per 300 m (1000 ft) of slope.
VL	Very Low - 1 or less actual or potential per 300 m (1000 ft) of slope.

Slump. The slump hazard refers to linear or bow-shaped failures, usually in seeps and low spots at the toe of slopes and is rated for areas according to five classes. The criteria considered in the development of these classes were slope gradient, and subsurface soil drainage. The presence of deep homogenous material associated with deep-seated creep, and an impermeable subsurface layer usually positioned concave upward were also considered. The slump hazard classes are the same as those used for the debris slide hazard.

Slump - Cut and Fill. The cut and fill slope slump hazard refers to linear or bow-shaped slope failures, usually in seeps and low spots at the toe of slopes and is rated for areas according to five classes. The criteria considered in the development of these classes was the same as those for the general slump hazard along with the depth and angle of the cut slope. The cut and fill slope slump hazard classes are:

Class	Cut and Fill Slump Hazard
VH	Very High - Cut slopes will yield excessively high volumes of material from mass failures and the road will require continuous removal of material to keep sediment from reaching streams and in some instances to maintain trafficability. Under normal conditions roads will not be economically feasible on these slopes.

H High - Cut slopes will yield high volumes of material from mass failures which require almost constant removal of material from the roadbed to keep sediment from reaching streams.

M Moderate - Cut slopes will yield such volumes of materials from mass failures that the road will only require seasonal removal of materials.

L Low - Cut slopes will yield only such volumes of material that only occasional removal of material will be required.

VL Very Low - No appreciable hazard of mass failure of the cut slopes.

Site Stability

Flood. The flood hazard refers to the potential of an area to flood and is rated according to three classes. The criteria considered in the development of these classes are the proximity to streams and height above streams, the height above flood waters, the geomorphic location of the site, and the slope, infiltration rate, permeability and drainage class of the area. The flood hazard classes are:

Class	Flood Hazard
L	Low
M	Moderate
H	High

Blowdown. The blowdown hazard refers to the potential of trees to be blown over by the wind and is rated for areas according to three classes. The criteria considered in the development of these classes are tree species present and available rooting depth as restricted by poor drainage, shallow soil or a restrictive layer, the occurance of past blowdowns as evidenced by hummocky microtopography, and the effect of surrounding features to channel wind currents. The blowdown hazard classes are:

Class	Blowdown Hazard
L	Low
M	Moderate
H	High

TABLE II

HAZARD RATINGS

Map Symbol	Description	Soil Number	% of Unit	Erosion: Surface Erosion	Erosion: Surface Erosion Cut & Fill	Restoration: Reforestation Potential	Restoration: Revegetation Potential Cut & Fill
AH	Alpine Highland	R	90	VL	VL	NA	NA
		1	10	L	M	VL	H
FCH	Frost Churned Highland	2	75	M	H	VL	L
		R	25	VL	VL	NA	NA
GS	Glacial Sideslope						
31	Forested Upper Sideslope	3	50	M	H	M	M
		4	30	H	VH	M	M
		2	10	VH	VH	M	M
		5	10	M	H	VL	H
32	Non-forested Upper Sideslope	1	50	H	H	VL	H
		2	20	M-H	VH	VL	H
		2	15	H	VH	VL	H
		5	10	M	H	VL	H
		2	5	H	VH	M	H
33	Forested Concave Lower Sideslope	6	50	M	H	M-L	M-H
		7	20	M	H	M	H
		1	15	M-H	M-H	H-M	H
		8	10	H	H	VL	L
		5	5	VL	VL	VH	H
34	Non-forested Concave Lower Sideslope	9	30	L-M	M	VL	L
		9	30	M	H	M	VL-H
		6	20	M-L	H-L	L-VL	H
		10	20	L	M	VL	H
35	Scree Fan	11	65	L-M	M	VL	L-H
		12	30	M	H	VL	L
		6	5	M	H	M-L	M-H
IS	Ice and Snow	-	100	-	-	-	-
GM	Glacial Moraine						
71	Low Relief Moraine	1	90	VL-M	L-H	VL	L-H
		14	10	VL	L	VL	H
72	High Relief Moraine	2	70	L-M	M-L	M	M
		6	15	L-M	M	M	H
		5	15	VL	VL	VL	M-VH

*"NA" Not Applicable

TABLE II

HAZARD RATINGS

	Slope Stability				Site Stability	
Avalanche	Soil Creep	Debris Slide	Slump	Slump Cut & Fill	Flood	Blowdown
L-H	NA*	L	NA	NA	NA	NA
M	L	L	L	M	NA	L
L	H	M	L-M	H	NA	NA
L	NA	M	NA	NA	NA	NA
L	H	VL	L	M	NA	H
M	H	L	L	L	NA	M
H	H	H	M	H	NA	L-M
H	H	M	M	H	NA	L
H	H	L	L	M	NA	L-M
H-VH	H-VH	M-H	M-H	H-VH	NA	L
H	H-VH	M-H	M	H	NA	L-M
VH	H	M	M	H	NA	L
M-L	H	M-H	M	H	NA	L-M
L-M	M	L-VL	L-M	M	NA	L-M
VL	M	VL	L	M	NA	M
VL-L	L-M	VL-L	VL-L	M-L	NA	L
M	M	VL	M	M	NA	L
VL-L	VL	VL	VL	VL	NA	M
L-H	VL-L	VL	VL-L	M-L	NA	L
H	M-H	L	L	M	NA	L
L-M	M-L	VL-M	L-VL	M-VL	NA	M-L
H	L	VL	L	M	NA	L
H-VH	M-L	VL	VL-L	L	NA	L
VH	H	M	L	M	NA	L
M-H	M	L-VL	L-M	M	NA	L
-	-	-	-	-	-	-
VL-L	VL-L	VL	VL	VL	L-M	L
VL	VL	VL	VL	L	H	L
VL	VL-L	VL	VL	L-M	L	M-L
VL	L-VL	VL-L	VL-L	L	L	L-M
VL	VL	VL	VL	VL	M	L

TABLE II

HAZARD RATINGS

Map Symbol	Description	Soil Number	% of Unit	Erosion: Surface Erosion	Erosion: Surface Erosion Cut & Fill	Restoration: Reforestation Potential	Restoration: Revegetation Potential Cut & Fill
GO	Glacial Outwash						
81	Alluvial Fan	11	60	VL-L	VL-M	M-L	L-H
		12	20	L	L	L	L
		13	10	L	M	L	M
		1	10	VL-M	VL-M	M-H	L-VH
82	Low-lying Flood Plain	14	70	VL	L	VL	H
		11	30	VL	L	VL	M
83	Stream Channel	14	100	H-VH	VH-H	VL	VL
84	Alluvium and Till River Sideslope	11	75	VH	VH	L	L-VL
		4	10	VH	VH	L-M	L-H
		6	10	VH	VH	VL	L
		11	5	VH	VH	VL	VL
85	Bedrock River Sideslope	6	40	VH	VH	M	H
		4	20	VH	VH	L-M	L-H
		15	20	VL	VL	VL	M
		R	20	NA	NA	NA	NA
86	High Elevation Valley Train	16	50	L-M	L-M	L-VL	L-H
		2	40	L	L	VL	L-H
		17	10	VL	VL	VL	L
87	Alluvial and Till Bench	2	35	VL	L	M	L-H
		6	30	VL-M	L-H	VL-H	L-H
		18	15	L	L	L	M
		19	10	VL-M	M-L	M	M-H
		20	5	L	M	L	H
		21	5	VL	L	L	M
88	Alluvial Terrace	1	50	VL-L	L-VL	L-H	VL-H
		1	20	VL	VL	L	L
		22	10	VL	VL	M	VH
		23	10	VL	VL-L	L-VL	H-M
		1	10	H	VH	M	VL
89	Forested Outwash Plain	24	40	VL-M	VL-M	M	H
		25	30	M	H	M	M
		11	20	VL	L-M	L	M-H
		1	10	VL	L	M	H

TABLE II

HAZARD RATINGS

Slope Stability					Site Stability	
Avalanche	Soil Creep	Debris Slide	Slump	Slump Cut & Fill	Flood	Blowdown
VL	VL	VL	VL	L-VL	M	M
VL	VL	VL	VL	L	H	M
VL	VL	VL	VL	M-H	L	M
VL	VL	VL	VL	VL-L	L-M	L-M
VL	VL	VL	VL	L	H	L
VL	VL	VL	VL	L	H	L
VL	VL	VL	VL	L	H	L
VL-H	H-VH	VH-L	H-M	H-VH	L	M-H
VL	H	L-VL	M-H	H	L	M-H
VL	VH	L	M	H	L	L
VL	H	VL	M	H	H	NA
L	H	L	H	VA	L	M
VL	H	L-VL	M-H	H	L	M-H
VH	VL	VH	VL	VL	L	L
L	NA	NA	NA	NA	L-H	NA
VL-L	VL	VL	VL	VL-L	L	L
VL-L	VL	VL	VL	VL-L	L	L
L	VL	VL	VL	L	H	L
VL	VL	VL	VL	L	M-L	L
VL	L-VL	VL	VL-L	L-VL	L	M-L
VL	VL	VL	VL	L	L	L
VL-M	L-VL	VL	VL-L	M-VL	L-M	L-M
VL	L	VL	L	M	L	H
VL	H	VL	VL	H	L	M
VL	VL	VL	VL	VL	L-M	L
VL	VL	VL	VL	VL	L	L
VL	VL	VL	VL	VL	L	M
VL	VL	VL	VL	VL	L-M	M-H
VL	H	VH	H	M	L	L
VL	VL	VL	VL	VL-L	M-H	M-L
VL	VL	VL	VL	VL	M	M
VL	VL	VL	VL	VL	L-H	M-H
VL	VL	VL	VL	L	M	M

TABLE II

HAZARD RATINGS

Map Symbol	Description	Soil Number	% of Unit	Erosion: Surface Erosion	Erosion: Surface Erosion Cut & Fill	Restoration: Reforestation Potential	Restoration: Revegetation Potential Cut & Fill
TM	Tidal Marsh	-	-	-	-	-	-
ISL	Ice Scoured Land						
101	Non-forested Ice Scoured Land	26	60	L-H	M-H	VL	M-L
		27	15	VL	VL	L	M
		2	15	M	M	VL	H
		R	10	NA	NA	NA	NA
102	Forested Ice Scoured Land	6	60	L-H	H-M	L	H-M
		28	10	H	H	M	H
		29	10	M-L	M-H	M-L	H-M
		33	10	VL	VL	VL	H
		30	5	L-M	M-H	L-M	H
		R	5	NA	NA	NA	NA
BL	Breakland						
111	Early Stage Breakland	31	75	M-VH	H-VH	VL	M-H
		11	10	M	H	L	H
		2	15	H	VH	VL	L
112	Mid-Stage Breakland	2	60	H	VH	VL	VL
		31	25	M-VH	H-VH	VL	M-H
		32	10	VH	VH	VL	VL
		R	5	NA	NA	NA	NA
113	Late Stage Breakland	31	45	M-VH	H-VH	VL	M-H
		32	35	VH	VH	VL	VL
		R	20	NA	NA	NA	NA
114	Headland	1	80	M	M	VL	L
		32	15	VH	VH	VL	VL
		R	5	NA	NA	NA	NA

TABLE II

HAZARD RATINGS

Slope Stability					Site Stability	
Avalanche	Soil Creep	Debris Slide	Slump	Slump Cut & Fill	Flood	Blowdown
-	-	-	-	-	H	L
VL	L-H	VL	L	L	L	L
VL	VL	VL	VL	VL	M	M
VL	L	VL	VL	L	L	L
VL	NA	VL	NA	NA	L	NA
L	M-L	L	L-M	L-H	L-M	L-M
L	H	L	M	H	L	L
VL-L	L-M	VL-L	VL-L	L	L	M-H
VL	VL	VL	VL	VL	L	L
VL	VL-M	VL-M	VL-L	M	L	L-M
L-VL	NA	VL	NA	NA	L	NA
M-VH	H-VH	M-H	L-H	M-VH	NA	NA
L	H	VL	L	M	NA	VL
H	H	M	M	H	NA	NA
VH	H	H	L	M	NA	NA
M-H	H-VH	M-H	L-H	M-VH	NA	NA
VH	VH	M	M	H	NA	NA
H-VH	NA	L	NA	NA	NA	NA
M-VH	H-VH	M-H	L-H	M-VH	NA	NA
VH	VH	M	M	H	NA	NA
VH	NA	M	NA	NA	NA	NA
VH	M	M	VL	L	NA	NA
VH	VH	M	M	H	NA	NA
H-VH	NA	L-M	NA	NA	NA	NA

APPENDIX C

DEVELOPMENT SUITABILITY RATINGS (15)

Map Symbol and Description. The identifying map symbol and descriptive title for each landtype and landtype association (mapping unit) are stated.

Soil Number and Percent of Unit. The number assigned to each soil family and the percentage of that soil within each mapping unit is stated. The letter "R" represents exposed rock and talus.

Definitions

Limitation Ratings. Soils are rated in their "natural state", that is, no unusual modifications of the soil, site or material is made other than that which is considered normal practice for the rated use.

Class	Limitation Ratings
F	Few is the rating given soils that have properties favorable for the use. The degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected.
M	Moderate is the rating given soils that have properties moderately favorable for the use. This degree of limitation can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance of the structure or other planned use is somewhat less desirable than for soils rated few. Some soils rated moderate require treatment such as artificial drainage, control of runoff to reduce erosion, extended septic tank absorption fields, extra excavation, or some modification of certain features through manipulation of the soil. For these soils, modification is needed for those construction plans generally used for soils of slight limitation. Modification may include specially designed foundations, extra reinforcement of structures, sump pumps, and the like.
S	Severe is the rating given soils that have one or more properties unfavorable for the rated use, such as steep slopes, bedrock near the surface, flooding, high shrink-swell potential, a seasonal high water table, or low strength. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance. Some of these soils, however, can be improved by reducing or removing the soil feature that limits use, but in most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for a severe degree of limitation.

Recreational Development

Soils are rated according to limitations that attect their suitability for camp areas, picnic areas, and paths and trails. Not considered in this rating, but important in evaluating a site are location accessibility of the area, size and shape of the area, and its scenic quality, the ability of the soil to support vegetation, access to water, availability of potential water impoundment sites, and either access to public service lines or the capacity of the soil

to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of duration and frequency of flooding is essential in planning recreational facilities.

Campgrounds and Picnic Areas. Campground and picnic areas are tracts of land used intensively for the activities of outdoor living and may include tents, trailers and campers. Site preparation may include shaping and leveling for table/tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. These areas are subject to heavy foot traffic and some vehicular traffic which may be confined to access roads and parking lots.

The soils of these areas are rated according to three classes on the basis of soil properties that influence the ease and cost of development, the trafficability and performance of the area after development, and the ability to promote the growth of vegetation after development and heavy use.

For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm to heavy foot traffic, and not be dusty when dry. Surface soil properties that influence trafficability are texture, wetness, permeability and the area of large stones. Clayey soils have slow permeability and silty soils are dusty. Soil properties that influence the growth of plants are depth to bedrock or cemented pan, permeability, and the presence of toxic materials. Soils that flood are particularly hazardous for development because of danger to life and property.

The main criteria considered for development are the slope and flooding potential, the surface soil drainage, erodibility, texture, stoniness and permeability, and the depth to bedrock. The limitations to campground and picnic area development are rated as few (F), moderate (M), and severe (S) as described above.

Paths and Trails. Paths and trails are used for walking, horseback riding, and other uses, and mostly require little or no cutting or filling. The soils are rated according to three classes on the basis of properties that influence trafficability and erodibility. The main criteria considered are the slope and flooding potential, and the texture, stoniness, erodibility, and drainage of the surface soil layer. The limitations on path and trail development are rated as few (F), moderate (M), and severe (S) as defined above.

Building Site Development

Soil limitation ratings are given for local roads, shallow excavations, and dwellings without basements. Soil properties influence development of building sites, including the selection of the site, the design of the structure, construction, and after construction, performance, and maintenance.

Local Roads. Local roads refers to the soil trafficability for construction of improved local roads and streets that have all-weather surfacing and that are expected to carry automobile traffic all year. These roads are graded to shed water and conventional drainage measures are provided. With the exception of a hard surface, the roads are built mainly from the soil at hand.

The properties that affect local roads and streets are those that influence the ease of excavation and grading, and traffic supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or cemented pan, depth to water table, flooding, the amount of large stones, and slope. The properties that affect traffic supporting capacity are soil strength, shrink-swell behavior, potential frost action, and depth to high water table. Soil slippage may be a problem on certain sloping soils. The local roads development limitations are rated as few (F), moderate (M), and severe (S) as defined above.

Shallow Excavations. Shallow excavations are trenches or holes dug in the soil to a maximum depth of 1.5 to 2m (5 to 6 ft). They are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, grave sites, and the like. The excavations are most commonly made by trenching machines or backhoes.

The ratings are based on the soil properties that influence ease of digging and the resistance to sloughing. Depth and hardness of bedrock or cemented pan, the bulk density of the soil and the amount of large stones influence the ease of digging, filling, and compacting. Depth to the seasonal high water table and flooding may restrict the time that the excavations can be made. Slope influences the ease of using digging machines. Soil texture and depth to water table influence the resistance to sloughing. The shallow excavation limitations are rated as few (F), moderate (M), and severe (S) as defined above.

Dwellings without Basements. Dwellings without basements are buildings of three stories or less without basements. The foundation is assumed to be spread footings of reinforced concrete built on undisturbed soil at a depth of 0.6 m (2 ft) or the depth of maximum frost penetration, whichever is deeper.

The ratings are based on properties affecting soil strength and settlement under a load, and those that affect excavation and construction costs. The properties affecting soil strength and settlement are the presence of a high water table and flooding, and the shrink-swell behavior and compressibility of the soils. Compressibility is inferred from the Unified classification.

Properties influncing the ease and amount of excavation are flooding, high water table, slope, depth to bedrock or cemented pan, and the amount of coarse fragments. The limitations to the development of dwellings without basements are rated as few (F), moderate (M), and severe (S) as defined above.

Sanitary Facility Development

The nature of the soil is important in selecting sites for sanitary landfills and septic tank absorption fields, and also in identifying those limiting soil properties and site features which need to be considered in planning, design, and installation. Those soil properties that determine the ease of excavation, installation and/or development of these facilities will also affect the ratings.

Septic Tank Absorption Fields. Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. The centerline depth of the tile is assumed to be at a depth of 61 cm (24 in). Only the soil between depths of 61 and 183 cm (24 and 72 in) is considered in making the ratings. The soil properties and site features

considered are those that affect the absorption of the effluent, those that affect the construction of the system, and those that may affect public health.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, cemented pan or ice, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock, ice, or cemented pan interfere with installation. Excess slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 1.2 m (4 ft) below the distribution lines. In these soils the absorption field may not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated.

Percolation tests are used by some regulatory agencies to evaluate the soil's suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity. The percolation rates do not correspond to the permeability rates because they are measured by different methods. Experience indicates that soils having percolation rates (1) faster than 45 minutes per 2.5 cm (1 in) function satisfactorily, (2) between 45 and 60 minutes per 2.5 cm (1 in) have moderate limitations, and (3) slower than 60 minutes per 2.5 cm (1 in) have severe limitations.

The limitations to the development of septic tank absorption fields are rated as few (F), moderate (M), and severe (S), as defined above. In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sanitary Landfills (trench). Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 0.6 m (2 ft) thick is placed over the landfill.

Ratings are based on properties to a depth normally observed during soil mapping. However, because trenches may be as deep as 4.5 m (15 ft) or more, geologic investigations are needed to determine the potential for pollution of ground water as well as determine the design needed. These investigations, generally arranged for by the landfill developer, include examination of stratification, rock formations, and geologic conditions that might lead to the conducting of leachates to aquifers, wells, water courses, and other water sources. The presence of hard nonripple bedrock, creviced bedrock, or highly permeable strats in or immediately underlying the proposed trench bottom is undesirable from the standpoints of excavation and potential pollution of underground water.

Properties that influence risk of pollution, ease of excavation, trafficability, and revegetation are major considerations. Soils

that flood or have a water table within the depth of excavation present a potential pollution hazard and cause difficulty in excavating.

Soil slope is an important consideration because it affects the work involved in road construction, the performance of the roads and the control of surface water around the landfill. Soil slope may also cause difficulty in construction of the trenches where the trench bottoms must be kept level and oriented to follow the contour.

The ease with which the trench is dug and with which a soil can be used as daily and final cover is based largely on texture and consistence of the soil. The texture and consistence of a soil determines the degree of workability of the soil both when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and to place in a uniformly thick cover over a layer of refuse.

The uppermost part of the final cover should be soil material that is favorable for the growth of plants. It should not contain excess sodium or salt and should not be too acid. In comparison with other horizons, the A horizon in most soils has the best workability and highest content of organic matter. Thus, for a trench-type landfill operation it may be desirable to stockpile the surface layer for use in final blanketing of the fill.

The limitations to the development of sanitary landfills are rated as few (F), moderate (M), and severe (S) as defined above. If soil slippage is observed, the soil should be rated severe.

Major Limiting Factors to Development

The factors most limiting to development on the given soil in each mapping unit are briefly stated. A more complete explanation of these limiting factors is given in the Management Considerations sections included in the Landtype Association and Landtype Descriptions.

Construction Materials

Soils are rated on the basis of the available evidence as potential borrow sources for roadfill, sand and gravel within or below the soil. The soils are rated in their "natural state", that is, no unusual modification of the soil site or materials are made other than that which is normal practice for the rated use.

Roadfill. Roadfill consists of soil material that is excavated from its original position and used in road embankments elsewhere. The evaluations for roadfill are for low embankments generally less than 1.8 m (6 ft) and are less exacting in design than high embankments such as used in superhighways. The rating is given for the whole soil, from the surface to a depth of about 1.5 m (5 ft), based on the assumption that soil horizons will be mixed in loading, dumping, and spreading. Soils are rated as to the amount of material available for excavation, the ease of excavation, and how well the material performs after it is in place.

Soil properties that affect the amount of material available for excavation are thickness of suitable material above bedrock or other material that is not as suitable. The percent of coarse fraction greater than 7.6 cm (3 in), depth to high water table and slope are properties that influence the ease of excavation. Some damage to the borrow area is expected, but if revegetation and erosion control could become serious problems, then the soil is rated severe.

The suitability of a soil as a source for road fill material is rated according to the following three classes:

Class	Roadfill Suitability Ratings
G	Good is the rating given to soils that have properties favorable for the use. Good performance and low maintenance can be expected.
F	Fair is the rating given to soils that are moderately favorable for the use. One or more soil properties make these soils less desirable than those rated good.
P	Poor is the rating given to soils that have one or more properties unfavorable for the use. Overcoming the unfavorable property requires special design, extra maintenance or costly alteration.

Sand. Sand as a construction material is usually defined as the size of particles ranging from .074 mm to 4.76 mm in diameter. Specifications for each purpose vary widely. The intent of this rating is to show only the probability of finding material in suitable quantity. The suitability of the sand for specific purposes is not evidenced.

The properties used to evaluate the soils as a probable source for sand are the grain size, the thickness of the sand layer, and the amount of rock fragments in the soil material.

The evaluation applies to layers at least 91 cm (36 in) thick and have less than 50 percent gravel less than 7.6 cm (3 in) in diameter. If the lowest layer of the soil contains sand, the soil is rated as a probable source regardless of thickness. The assumption is that the sand layer below the depth of observation exceeds the minimum thickness.

The suitability of a soil as a borrow source for sand is rated according to the following four classes:

Class	Sand and Gravel Suitability Rating
G	Good is the rating given to soils that have properties favorable as a borrow source.
F	Fair is the rating given to soils that are moderately favorable as a borrow source.
P	Poor is the rating given to soils that have one or more properties unfavorable for a borrow source.
U	Unsuited is the rating given to soils that due to properties are not suited for a borrow source.

Gravel. Gravel as a construction material is defined as the size of particles ranging from 4.76 mm to 76 mm in diameter. Gravel is used in great quantities in many kinds of construction. Specifications for each purpose vary widely. The intent of this rating is to show only the probability of finding material in suitable quantity. The suitability of the gravel for specific purposes is not evaluated.

The properties used to evaluate the soil as a probable source for gravel are grain size, the thickness of the gravel layer and the amount of rock fragments in the soil material. The evaluation applies to layers at least 91 cm (36 in) thick and have less than 50 percent gravel less than 7.6 cm (3 in) in diameter. If the lowest layer of the soil contains gravel, the soil is rated as a probable source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness.

The suitability of a soil as a borrow source for gravel is rated according to four classes as good (G), fair (F), poor (P), and unsuited (U) as described above.

TABLE III

DEVELOPMENT SUITABILITY RATINGS

Map Symbol	Description	Soil Number	% of Unit	Recreation: Campground & Picnic Areas	Recreation: Paths and Trails	Building Sites: Local Roads	Building Sites: Shallow Excavations	Building Sites: Dwellings Without Basements
AH	Alpine Highland	R	90	S	S	S	S	S
		1	10	S	S	S	S	S
FCH	Frost Churned	2	75	S	S	S	S	S
	Highland	R	25	S	S	S	S	S
GS	Glacial Sideslope							
31	Forested Upper	3	50	S	S	S	S	S
	Sideslope	4	30	S	S	S	S	S
		2	10	S	S	S	S	S
		5	10	S	S	S	S	S
32	Non-forested	1	50	S	S	S	S	S
	Upper Sideslope	2	20	S	S	S	S	S
		2	15	S	S	S	S	S
		5	10	S	S	S	S	S
		2	5	S	S	S	S	S
33	Forested Concave	6	50	S	S	S	S	S
	Lower Sideslope	7	20	S	M	S	S	S
		1	15	M-S	M	M-S	S	M-S
		8	10	S	M-S	S	S	S
		5	5	S	S	S	S	S
34	Non-forested Concave	9	30	S	M-S	S	S	S
	Lower Sideslope	9	30	S	M-S	M-S	S	S
		6	20	M-S	M-S	M-S	S	M-S
		10	20	S	M	S	S	S
35	Scree Fan	11	65	M-S	M	S	S	M-S
		12	30	S	S	S	S	S
		6	5	S	S	S	S	S
IS	Ice and Snow	-	100	S	S	S	S	S
GM	Glacial Moraine							
71	Low Relief	1	90	F-S	F-M	F-S	S	M-S
	Moraine	14	10	S	S	S	S	S
72	High Relief	2	70	F-S	F	F-S	F-S	F-S
	Moraine	6	15	F-S	F	F-S	M-S	F-S
		5	15	S	S	S	S	S

"NA" Not Applicable

TABLE III

DEVELOPMENT SUITABILITY RATINGS

Sanitary Facilities		Major Limiting Factors to Development	Construction Material		
Septic Tank Absorption Fields	Sanitary Landfills		Roadfill	Sand	Gravel
S	S	Slope, rock at surface	NA	NA	NA
S	S	Slope, depth to rock	F-P	P	U
S	S	Slope, shallow	F-P	U	U
S	S	Slope, rock at surface	NA	NA	NA
S	S	Slope	G-F	G	P
S	S	Slope, shallow	P	U	P-U
S	S	Slope	P-F	U	U
S	S	Slope	P	U	G
S	S	Slope	P-F	U	G
S	S	Slope, depth to rock	P-F	U	U-P
S	S	Slope, depth to rock	P-F	U	P
S	S	Slope	P	U	G
S	S	Slope	P-F	U	U-P
S	S	Slope	P-M	U-P	F-G
S	S	Slope	F	U	P
M-S	M-S	Slope, coarse fragments	F	U-P	F-G
S	S	Slope, depth to cemented pan	P	U	P-U
S	S	Excess humus	P	U	U
S	S	Slope	F	U-P	P-F
S	S	Slope	P-F	P	F
S	S	Slope, coarse fragments	F	P-G	F-P
S	S	Slope, depth to cemented pan	F-P	U	U
S	S	Slope, coarse fragments, large stones	F	U	F
S	S	Slope	P	U	U
S	S	Slope, coarse fragments	F	P-G	F-P
S	S	Ice and snow	NA	NA	NA
S	S	Slope, coarse fragments, poor filter	F-G	P	P
S	S	Wetness	F	P	P
M-S	F-S	Slope, perks slowly	F	U-P	U-P
F-S	F-S	Slope, coarse fragments	M	G-U	F-G
S	S	Wetness, excess humus	P	U	U

TABLE III

DEVELOPMENT SUITABILITY RATINGS

Map Symbol	Description	Soil Number	% of Unit	Recreation: Campground & Picnic Areas	Recreation: Paths and Trails	Building Sites: Local Roads	Building Sites: Shallow Excavations	Building Sites: Dwellings without Basements
GO	Glacial Outwash							
81	Alluvial Fan	11	60	F	F	F	S	F
		12	20	F	F	M	S	M
		13	10	F	F	M	F	F
		1	10	F	F	F	S	F
82	Low-lying Flood Plain	14	70	S	S	S	S	S
		11	30	S	S	S	S	S
83	Stream Channel	14	100	S	S	S	S	S
84	Alluvium and Till River Sideslope	11	75	S	S	S	S	S
		4	10	S	S	S	S	S
		6	10	S	S	S	S	S
		11	5	S	S	S	S	S
85	Bedrock River Sideslope	6	40	S	S	S	S	S
		4	20	S	S	S	S	S
		15	20	S	S	S	S	S
		R	20	S	S	S	S	S
86	High Elevation Valley Train	16	50	F-M	F	S	S	S
		2	40	F-M	F	F-M	S	F-M
		17	10	S	S	S	S	S
87	Alluvial and Till Bench	2	35	M-S	F	M-S	M-S	M-S
		6	30	F-S	F-S	F-S	S	F-S
		18	15	S	M	S	S	M
		19	10	F-S	F-M	S	M-S	M-S
		20	5	S	S	S	S	S
		21	5	S	S	S	S	S
88	Alluvial Terrace	1	50	F	F	F	M	F
		1	20	F	F	F	M	F
		22	10	S	S	S	S	M
		23	10	F	F	F	S	F
		1	10	S	S	S	S	S
89	Forested Outwash Plain	24	40	F	F	S	F	F
		25	30	F	F	F	S	F
		11	20	F	F	F	S	F
		1	10	F	F	M	S	M

TABLE III

DEVELOPMENT SUITABILITY RATINGS

Sanitary Facilities		Major Limiting Factors to Development	Construction Material		
Septic Tank Absorption Fields	Sanitary Landfills		Roadfill	Sand	Gravel
S	S	Coarse fragments, poor filter	F	P-U	P-G
S	S	Coarse frag, large stones,poor filter	P	U	U
S	S	Perks slowly	F-P	F-P	P
F	F	Coarse fragments	G	P-G	G-P
S	S	Wetness, flooding	F	P	P
S	S	Flooding, coarse fragments	F	P	G
S	S	Wetness, flooding	F	P	P
S	S	Slope	P	P-U	G-P
S	S	Slope, shallow	P	U	P-U
S	S	Slope	P	P	G
S	S	Slope	P	P	G
S	S	Slope	P	G	P
S	S	Slope, shallow	P	U	P-U
S	S	Slope, shallow	P	U	U
S	S	Slope, rock at surface	NA	NA	NA
M-S	M-S	Slope, wetness, frost action	P	P-U	P-U
F-M	F-M	Slope, coarse fragments	P	P-F	F-G
S	S	Wetness, frost action	P	U	U
M-S	S	Slope, large stones	F-G	U	U-P
S	S	Slope, coarse fragments, poor filter	G-F	P-G	G-P
S	S	Slope, wetness	P	U	U
M-S	M-S	Slope, wetness, frost action	P-G	U-P	U-G
S	S	Slope, wetness	P	U	U
S	S	Wetness, excess humus	P	U	U
S	S	Poor filter	G-P	P-U	P-G
S	S	Poor filter	F-P	P-F	F
S	S	Wetness, low bearing strength	P	U	U
F	F	Coarse fragments	F-G	P-U	U-P
S	S	Slope	P	U	P
M	F	Low bearing strength, perks slowly	F-P	U-F	U-G
S	M	Wetness	G-F	P	G-F
S	S	Coarse fragments, poor filter	G-F	P	G
S	S	Large stones, poor filter	G	P	P

TABLE III

DEVELOPMENT SUITABILITY RATINGS

Map Symbol	Description	Soil Number	% of Unit	Recreation: Campground & Picnic Areas	Recreation: Paths and Trails	Building Sites: Local Roads	Building Sites: Shallow Excavations	Building Sites: Dwellings without Basements
TM	Tidal Marsh	-	-	-	-	-	-	-
ISL	Ice Scoured Land							
101	Non-forested Ice Scoured Land	26	60	S	F-S	S	S	S
		27	15	S	S	S	S	S
		2	15	M-S	M	M-S	M-S	M-S
		R	10	S	S	S	S	S
102	Forested Ice Scoured Land	6	60	M-S	M-S	M-S	M-S	M-S
		28	10	S	S	S	S	S
		29	10	S	F-S	S	S	S
		33	10	S	S	S	S	S
		30	5	F-S	F-S	M-S	S	M-S
		R	5	S	S	S	S	S
BL	Breakland							
111	Early Stage Breakland	31	75	S	S		S	S
		11	10	S	S		S	S
		2	15	S	S		S	S
112	Mid-stage Breakland	2	60	S	S		S	S
		31	25	S	S		S	S
		32	10	S	S		S	S
		R	5	S	S		S	S
113	Late Stage Breakland	31	45	S	S		S	S
		32	35	S	S		S	S
		R	20	S	S		S	S
114	Headland	1	80	S	S		S	S
		32	15	S	S		S	S
		R	5	S	S		S	S

TABLE III

DEVELOPMENT SUITABILITY RATING

Sanitary Facilities		Major Limiting Factors to Development	Construction Material		
Septic Tank Absorption Fields	Sanitary Landfills		Roadfill	Sand	Gravel
-	-	Wetness, tidal inundation	-	-	-
S	S	Shallow, slope	P	U	U
S	S	Shallow, excess humus	P	U	U
S	S	Slope, depth to rock	F	P	P-F
S	S	Slope, rock at surface	NA	NA	NA
M-S	M-S	Slope, depth to rock	P-F	U-G	P
S	S	Slope	P	P	G
S	S	Shallow, slope	P	U	U
S	S	Excess humus	P	U	U
S	S	Slope, depth to rock	P	U	U-P
S	S	Slope, rock at surface	NA	NA	NA
S	S	Slope	P	U	U-P
S	S	Slope	P	U	F
S	S	Slope	P	U	U
S	S	Slope	P	U	U
S	S	Slope	P	U	U-P
S	S	Slope	P	U	U
S	S	Slope, rock at surface	NA	NA	NA
S	S	Slope	P	U	U-P
S	S	Slope	P	U	U
S	S	Slope, rock at surface	NA	NA	NA
S	S	Slope	P	U	F-P
S	S	Slope	P	U	U
S	S	Slope, rock at surface	NA	NA	NA

APPENDIX D

SOIL PEDON DESCRIPTIONS (6)

Soil Number 1

Taxonomic Class: Dystric Cryochrepts, sandy-skeletal, mixed.

Typical Location: These soils are very wide ranging being found mostly in the following units: Alpine Highland (AH), Non-forested Upper Sideslope (32), Forested Concave Lower Sideslope (33), Low Relief Moraine with Outwash Plain (71), Alluvial Fan (81), Alluvial Terrace (88), Forested Outwash Plain (89), and Headland (114). They are found mostly on stable well drained sites with a well developed vegetation cover which is highly variable, but they may not be forested due to exposure.

Typical Pedon:

0	12-0 cm (5-0 in)	Undecomposed and decomposed organic material.
A21	0-9 cm (0-4 in)	Dark reddish brown (5YR 3/2) fine sandy loam; weak, fine granular structure; friable, nonsticky and slightly plastic consistence; 10 percent gravel and 5 percent cobbles by volume; very strongly acid (pH 4.8); gradual wavy boundary.
A22	9-20 cm (4-8 in)	Dark reddish brown (5YR 3/3) loam; weak, fine granular structure; friable, slightly sticky and slightly plastic consistence; 35 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.2); clear wavy boundary.
B2	20-40 cm (8-16 in)	Dark brown (7.5YR 3/4) fine sandy loam; weak fine granular; friable, slightly sticky and slightly plastic consistence; 45 percent gravel and 15 percent cobbles by volume; strongly acid (pH 5.4); clear wavy boundary.
C	40-55 cm (16-22 in)	Very dark grayish brown (10YR 3/2) loamy sand; single grain to massive structure; very friable, nonsticky and nonplastic consistence; 45 percent gravel and 15 percent cobbles by volume; strongly acid (pH 5.4).

Soil Number 2

Taxonomic Class: Dystric Cryochrepts, loamy-skeletal, mixed

Typical Location: These soils are very wide ranging being found mostly in the following units: Frost Churned Highland (FCH), Forested Upper Sideslope (31), Non-forested Upper Sideslope (32), High Relief Moraine (72), High Elevation Valley Train (86), Alluvial and Till Bench (87), Non-forested Ice Scoured Land (101), Early Stage Breakland (111), and Mid-Stage Breakland (112). They are found mostly on well drained sites of moderate stability and are often not forested due to instability or exposure, but have a well developed vegetative cover.

Typical Pedon:

01	5-0 cm (2-0 in)	Undecomposed organic material.

A11	0-13 cm (0-5 in)	Dark reddish brown (5YR 2.5/2) loam; weak, very fine granular structure; very friable, slightly sticky and slightly plastic consistence; 20 percent gravel and 20 percent cobbles by volume; strongly acid (pH 5.2); clear wavy boundary.
A12	13-38 cm (5-15 in)	Dark reddish brown (5YR 2.5/2) sandy loam; weak very fine granular structure; very friable, slightly sticky and nonplastic consistence; 35 percent gravel and 35 percent cobbles by volume; strongly acid (pH 5.5); gradual wavy boundary.
B2	38-54 cm (15-21 in)	Dark brown (7.5YR 3/2) sandy loam; weak, very fine granular structure; very friable, nonsticky and nonplastic consistence; 20 percent gravel and 30 percent cobbles by volume; medium acid (pH 6.0); clear wavy boundary.
C	54-80 cm) (21-32 in)	Very dark grayish brown (10YR 3/2) sandy loam; massive structure; very friable, nonsticky and nonplastic consistence; 10 percent gravel and 40 percent cobbles by volume; slightly acid (pH 6.3).

Soil Number 3

Taxonomic Class: Humic Cryorthods; sandy-skeletal, mixed.

Typical Location: These soils are found mostly in the Forested Upper Sideslope (31) unit. They are found mostly on stable well drained sideslopes with a vegetative cover of mountain hemlock with rusty menziesia.

Typical Pedon:

0	5-0 cm (2-0 in)	Undecomposed and decomposed organic material.
A2	0-5 cm (0-2 in)	Dark grayish brown (10YR 4/2) loam; weak, fine granular structure; very friable, slightly sticky and slightly plastic consistence; 5 percent gravel and 20 percent cobbles by volume; extremely acid (pH 4.3); clear wavy boundary.
B21hir	5-21 cm (2-8 in)	Very dusky red (2.5YR/ 2.5/2) sandy loam; weak, very fine granular structure; very friable, slightly sticky and slightly plastic consistence; 10 percent gravel and 20 percent cobbles by volume; extremely acid (pH 4.4); clear broken boundary.
B22ir	21-29 cm (8-11 in)	Dark brown (7.5YR 3/2) sandy loam; weak, very fine granular structure; friable, slightly sticky and slightly plastic consistence; 10 percent gravel and 10 percent cobbles by volume; very strongly acid (pH 4.6); clear wavy boundary.
B23ir	29-46 cm (11-18 in)	Dark yellowish brown (10YR 3/4) loamy sand; weak, very fine granular to massive structure; very friable, slightly sticky and nonplastic consistence; 25 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.3); clear wavy boundary.
B3	46-72cm (18-28 in)	Very dark grayish brown (10YR 3/2) loamy sand; weak fine granular to massive structure; very friable, slightly sticky and nonplastic consistence; 25 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.3); clear wavy boundary.

C	72-100 cm (28-39 in)	Dark olive gray (5Y 3/2) coarse sand, massive structure; very friable, nonsticky and nonplastic consistence; 30 percent gravel and 20 percent cobbles by volume; medium acid (pH 5.8).

Soil Number 4

Taxonomic Class: Lithic Cryorthods, loamy-skeletal, mixed.

Typical Location: These soils are of limited range being found mostly in the following units: Forested Upper Sideslope (31), River Cut Sideslopes into Alluvium and Till (84), and River Cut Sideslopes into Bedrock (85). They are found mostly on well to somewhat excessively drained slopes, shallow to bedrock, with mountain hemlock as all or part of the canopy.

Typical Pedon:

01	8-3 cm (3-1 in)	Undecomposed needles and moss.
02	3-0 cm (1-0 in)	Decomposed organic material.
A2	0-7 cm (0-3 in)	Gray (5Y 5/1) fine sandy loam; weak, fine granular structure; friable, slightly sticky and slightly plastic consistence; 10 percent gravel and 5 percent cobbles by volume; very strongly acid (pH 4.5); abrupt irregular bounday.
B21hir	7-10 cm (3-4 in)	Black (5YR 2.5/1) sandy loam; weak, fine granular structure; friable, slightly sticky and slightly plastic consistence; 20 percent gravel and 15 percent cobbles by volume; strongly acid (pH 5.5); abrupt irregular boundary.
B22ir	10-38 cm (4-15 in)	Yellowish red (5YR 4/6) mixed with brown to dark brown (7.5YR 4/4) sandy loam; weak, fine granular structure; friable, slightly sticky and slightly plastic consistence; 20 percent gravel and 20 percent cobbles by volume; strongly acid (pH 5.5); abrupt irregular boundary.
R	38 cm (15 in)	Shale, siltstone, slate and argillite.

Soil Number 5

Taxonomic Class: Terric Borosaprists, loamy-skeletal, mixed, euic.

Typical Location: These soils are moderately wide ranging being found mostly in the following units: Forested Upper Sideslope (31), Non-forested Upper Sideslope (32), Forested Concave Lower Sideslope (33), and High Relief Moraine (72). They are found mostly on poorly drained sites, some with excessive water due to seepage along drainages. The vegetative cover varies from an alder/devils club with grass and ferns to a black spruce/labrador tea muskeg type.

Typical Pedon:

Oi	0-3 cm (0-1 in)	Moss, dead ferns and leaves.

Oe	3-13 cm (1-5 in)	Dark reddish brown (5YR 3/2) broken face to very dusky red (2.5YR 2.5/2) when pressed, mucky peat; about 25 percent fibers, 5 percent when rubbed; very strongly acid (pH 4.6); abrupt smooth boundary.
Oa1	13-30 cm (5-12 in)	Black (N 2/0) muck; about 5 percent fibers; extremely acid (pH 4.1); abrupt wavy boundary.
C1	30-33 cm (12-13 in)	Brown (7.5YR 5/2) loam; massive structure, friable, sticky and slightly plastic consistence; 50 percent gravel and 5 percent cobbles by volume; extremely acid (pH 4.3); clear wavy boundary.
Oa2	33-45 cm (13-18 in)	Black (N 2/0) muck; strong, very fine angular blocky structure; extremely acid (pH 5.3); clear wavy boundary.
Oa3	45-56 cm (18-22 in)	Black (N 2/0) muck; medium, coarse angular blocky structure; strongly acid (pH 5.3); clear wavy boundary.
C2	56-86 cm (22-34 in)	Brown to dark brown (7.5YR 4/4) loam; massive structure; friable, slightly sticky and nonplastic consistence; 50 percent gravel and 10 percent cobbles by volume; medium acid (pH 5.6); clear wavy boundary.
C3	86-115 cm (34-45 in)	Dark brown (7.5YR 3/4) sandy loam; massive structure; friable, nonsticky and nonplastic consistence; 50 percent gravel and 10 percent cobbles by volume; medium acid (pH 5.8).

Soil Number 6

Taxonomic Class: Typic Cryorthods, sandy-skeletal, mixed.

Typical Location: These soils are extremely wide ranging being found mostly in the following units: Forested Concave Lower Sideslope (33), Non-forested Concave Lower Sideslope (34), Scree Fan (35), High Relief Moraine (72), River Cut Sideslope into Alluvium and Till (84), River Cut Sideslope into Bedrock (85), Alluvial and Till Bench (87), and Forested Ice Scoured Land (102). They are found mostly on well to somewhat excessively drained slopes with two major vegetative covers of alder/grass and mountain hemlock/white spruce with paper birch.

Typical Pedon:

O	10-0 cm (4-0 in)	Undecomposed and decomposed organic material.
A2	0-6 cm (0-2 in)	Gray (10YR 5/1) fine sandy loam; weak, very fine granular structure; very friable, nonsticky and nonplastic consistence; 5 percent gravel by volume; very strongly acid (pH 4.5); abrupt wavy boundary.
B21ir	6-14 cm (2-6 in)	Very dusky red (2.5YR 2.5/2) loamy sand; moderate, very fine granular structure; friable, nonsticky and nonplastic consistence; 5 percent gravel by volume; very strongly acid; abrupt broken boundary.
B22ir	14-18 cm (6-7 in)	Dark brown (7.5YR 3/4) loamy sand; moderate, very fine granular structure; friable, nonsticky and nonplastic consistence; 10 percent gravel and 5 percent cobbles by volume; strongly acid (pH 5.3); clear wavy boundary.

B3	18-24 cm (7-9 in)	Brown to dark brown (7.5YR 4/4) sandy loam; moderate, very fine granular structure; very friable, slightly sticky and nonplastic consistence; 15 percent gravel and 5 percent cobbles by volume; strongly acid (pH 5.3); clear wavy boundary.
C1	24-30 cm (9-12 in)	Dark yellowish brown (10YR 4/4) coarse sand, single grain structure; loose, nonsticky and nonplastic consistence; 30 percent fine gravel and 5 percent cobbles by volume; medium acid (pH 5.7); clear wavy boundary.
C2	30-100cm (12-39 in)	Very dark grayish brown (10YR 3/2) coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 60 percent fine gravel and 5 percent cobbles by volume; medium acid (pH 6.0).

Soil Number 7

Taxonomic Class: Cryic Fragiorthods, loamy-skeletal, mixed.

Typical Location: These soils are found mostly in the Forested Concave Lower Sideslope (33) unit on moderately well drained slopes with a vegetative cover of Sitka alder with red elderberry and grass.

Typical Pedon:

01	7-0 cm (3-0 in)	Dead matted grass and leaves.
A1	0-15 cm (0-6 in)	Very dark grayish brown (10YR 3/2) silt loam; weak, fine, granular structure; very friable, slightly sticky and slightly plastic consistence; medium acid (pH 5.6); abrupt broken boundary.
A2	15-17 cm (6-7 in)	Dark gray (10YR 4/1) silt loam; weak, very fine granular structure; very friable, sticky and slightly plastic consistence; medium acid (pH 5.6); abrupt broken boundary.
B21ir	17-24 cm (7-9 in)	Dark reddish brown (5YR 2.5/2) silt loam; moderate, very fine granular structure; very friable, slightly sticky and slightly plastic consistence; medium acid (pH 5.6); clear wavy boundary.
B22ir	24-34 cm (9-13 in)	Brown to dark brown (10YR 4/3) silt loam; moderate, fine granular structure; very friable, sticky and plastic consistence; medium acid (pH 5.6); gradual wavy boundary.
IIB23	34-45 cm (13-18 in)	Brown (10YR 5/3) loam; moderate, fine granular structure; very friable, sticky and plastic consistence; 20 percent gravel and 20 percent cobbles by volume; medium acid (pH 5.9); clear wavy boundary.
IIC1	45-66 cm (18-26 in)	Dark grayish brown (10YR 4/2) sandy loam; weak, very fine granular structure; very friable, slightly sticky and slightly plastic consistence; 30 percent gravel and 10 percent cobbles by volume; medium acid (pH 6.0); clear wavy boundary.
IIC2m	66-100 cm (26-39 in)	Grayish brown (2.5Y 5/2) sandy loam; massive structure; very firm, slightly sticky and slightly plastic consistence; 30 percent gravel and 20 percent cobbles by volume; medium acid (pH 6.0).

Soil Number 8

Taxonomic Class: Type Fragiocrepts, sandy-skeletal, mixed.

Typical Location: These soils are found mostly in the higher elevations of the Forested Concave Lower Sideslope (33) unit on moderately well to well drained slopes with a vegetative cover of grass with birch and willow shrubs.

Typicl Pedon:

01	5-0 cm (2-0 in)	Moss, matted grass and leaves.
A2	0-6 cm (0-2 in)	Dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable, nonsticky and slightly plastic consistence; 5 percent fine gravel by volume, very strongly acid (pH 4.7); clear wavy boundary.
B21	6-17 cm (2-7 in)	Dark brown (7.5YR 3/3) coarse sandy loam; moderate, fine granular structure; very friable, nonsticky and nonplastic consistence; 15 percent fine gravel, 10 percent gravel and 10 percent cobbles by volume; very strongly acid (pH 5.0); gradual wavy boundary.
B22	17-28 cm (7-11 in)	Dark reddish brown (5YR 3/3) sandy loam; moderate, fine granular structure; very friable, nonsticky and slightly plastic consistence; 10 percent fine gravel, 10 percent gravel and 25 percent cobbles by volume; strongly acid (pH 5.5); gradual wavy boundary.
B23	28-40 cm (11-16 in)	Dark brown (7.5YR 3/2) loamy coarse sand; weak, fine granular structure; very friable, nonsticky and nonplastic consistence; 10 percent fine gravel, 10 percent gravel and 10 percent cobbles by volume; medium acid (pH 5.7); abrupt wavy boundary.
Cm	40-69 cm (16-27 in)	Dark brown (10YR 3/3) loamy coarse sand; massive structure; very firm, nonsticky and nonplastic consistence; 10 percent fine gravel, 25 percent gravel and 15 percent cobbles by volume; neutral (pH 6.7).

Soil Number 9

Taxonomic Class: Typic Cryorthods, loamy-skeletal, mixed.

Typical Location: These soils are found mostly in the Non-forested Concave Lower Sideslope (34) unit on well drained slopes with a vegetative cover of mostly grasses with spirea.

Typical Pedon:

01	4-0 cm (2-0 in)	Matted grass and leaves.
A21	0-7 cm (0-3 in)	Dark reddish brown (5YR 3/2) loamy fine sand; weak, fine granular structure; friable, nonsticky and nonplastic consistence; very strongly acid (pH 4.8); clear smooth boundary.
A22	7-12 cm (3-5 in)	Dark reddish brown (5YR 3/2) loamy fine sand; single grain structure; friable, nonsticky and nonplastic consistence; 15 percent gravel and 15 percent cobbles by volume; very strongly acid (pH 5.0); clear smooth boundary.

B21hir	12-20 cm (5-8 in)	Very dusky red (2.5YR 2.5/2) fine sandy loam; moderate, very fine granular structure; friable, nonsticky and nonplastic consistence; 25 percent gravel and 15 percent cobbles by volume; strongly acid (pH 5.3); clear irregular boundary.
B22ir	20-43 cm (8-17 in)	Dark reddish brown (5YR 3/2) sandy loam; moderate, very fine granular structure; friable, nonsticky and nonplastic consistence; 25 percent gravel and 15 percent cobbles by volume; strongly acid (pH 5.3); gradual smooth boundary.
B23ir	43-69 cm (17-27 in)	Dark reddish brown (5YR 3/3) sandy loam; weak, fine granular structure; friable, slightly sticky and slightly plastic consistence; 25 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.5); clear smooth boundary.
C	69-100 cm (27-39 in)	Very dark grayish brown (2.5Y 3/2) fine sandy loam; massive structure; firm, nonsticky and nonplastic consistence; 35 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.5).

Soil Number 10

Taxonomic Class: Cryic Fragiorthods, coarse-loamy, mixed.

Typical Location: These soils are found mostly in the Non-forested Concave Lower Sideslope (34) unit on naturally disturbed slopes which are moderately well-drained with seepage along the compact till contact. The vegetative cover is composed mostly of sitka alder, some elderberry and shrub willow with ferns and grasses.

Typical Pedon:

O1	20-8 cm (8-3 in)	Matted ferns and moss.
O2	8-0 cm (3-0 in)	Decomposed organic material.
A2	0-1 cm (1-.5 in)	Brown (10YR 5/3) loam; moderate, very fine granular structure; friable, sticky and plastic consistence; extremely acid (pH 4.3); abrupt wavy and broken boundary.
B21hir	1-6 cm (.5-2 in)	Very dusky red (2.5YR 2.5/2) fine sandy loam; weak, fine granular structure; 5 percent gravel by volume; strongly acid (pH 5.2); clear wavy boundary.
B22ir	6-23 cm (2-9 in)	Dark brown (7.5YR 3/4) loamy sand; weak, fine granular structure; very friable, nonsticky and nonplastic consistence; 15 percent gravel by volume; strongly acid (pH 5.2); clear wavy boundary.
B3	23-30 cm (9-12 in)	Light yellowish brown (10YR 6/4) sandy loam; many, medium, distinct, reddish yellow (5YR 6/6) mottles; moderate, fine granular structure; very friable, sticky and slightly plastic consistence; 15 percent gravel by volume; strongly acid (pH 5.2); clear wavy boundary.
Cm	30-40 cm (12-16 in)	Grayish brown (2.5Y 5/2) sandy loam; massive structure; firm, slightly sticky and slightly plastic consistence; 20 percent gravel by volume; strongly acid (pH 5.5).

Soil Number 11

Taxonomic Class: Typic Cryorthents, sandy-skeletal, mixed.

Typical Location: These soils are wide ranging being found mostly in the following units: Scree Fan (35), Alluvial Fan (81), Low-lying Flood Plain (82), River Cut Sideslope into Alluvium and Till (84), Forested Outwash Plain (89), and Early Stage Breakland (111). They are found mostly on well to moderately well drained sites with a vegetative cover that usually has spruce as part of the canopy but is highly variable to no canopy at all.

Typical Pedon:

O	6-0 cm (2-0 in)	Undecomposed and decomposed organic material.
A2	0-3 cm (0-1 in)	Dark brown (7.5YR 3/2) loam; weak, very fine granular structure; friable, slightly sticky and slightly plastic consistence; 25 percent gravel by volume; very strongly acid (pH 5.0); abrupt broken boundary.
C1	3-18 cm (1-7 in)	Brown to dark brown (10YR 4/3) loam; massive structure; friable, sticky and plastic consistence; 25 percent gravel and 25 percent cobbles by volume; very strongly acid (pH 5.0); gradual wavy boundary.
C2	18-37 cm (7-15 in)	Brown to dark brown (10YR 4/3) sandy loam; massive structure; very friable, slightly sticky and nonplastic; 40 percent gravel and 30 percent cobbles by volume; very strongly acid (pH 5.0); gradual wavy boundary.
C3	37-100 cm (15-39 in)	Dark brown (10YR 3/3) coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 50 percent gravel and 20 percent cobbles by volume; very strongly acid (pH 5.0).

Soil Number 12

Taxonomic Class: Typic Cryorthents, fragmental, mixed.

Typical Location: These soils are found along stream channels mostly in the Scree Fan (35) and Alluvial Fan (81) units on well drained sites. The two vegetative covers are mostly grass/sedge with dwarf birch and crowberry, and cottonwood/alder with spruce, devils club and grass.

Typical Pedon:

O1	6-2 cm (2-1 in)	Moss, matted sedge, grass and leaves.
O2	2-0 cm (1-0 in)	Decomposed organic material; clear smooth boundary.
A1	0-40 cm (0-16 in)	Very dark grayish brown (10YR 3/2) silt loam; weak, very fine granular structure; friable, slightly sticky and slightly plastic consistence; 15 percent fine gravel and 10 percent gravel by volume; very strongly acid (pH 4.5); diffuse smooth boundary.

C1	40-69 cm (16-27 in)	Very dark brown (10YR 2/2) sandy loam; weak, very fine granular to single grain structure; loose, nonsticky and nonplastic consistence; 50 percent fine gravel, 20 percent gravel and 15 percent cobbles by volume; slightly acid (pH 6.5); abrupt wavy boundary.
C2	69-100 cm (27-39 in)	Very dark grayish brown (10YR 3/2) coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 40 percent gravel, 15 percent cobbles and 40 percent stones by volume; neutral (pH 6.8).

Soil Number 13

Taxonomic Class: Aquic Cryorthents, sandy, mixed.

Typical Location: These soils are found mostly in the Alluvial Fan (81) unit on moderately well drained gently sloping sites with a vegetative cover of mostly willow with some spruce and cottonwood.

Typical Pedon:

O1	3-0 cm (1-0 in)	Moss needles and matted grass.
A1	0-4 cm (0-2 in)	Very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable, nonsticky and nonplastic consistence; 15 percent gravel by volume; extremely acid (pH 4.3); abrupt wavy boundary.
C1	4-11 cm (2-4 in)	Very dark brown (10YR 2/2) coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 60 percent gravel by volume; very strongly acid; abrupt smooth boundary.
C2	11-15 cm (4-6 in)	Black (5Y 2.5/2) sand; single grain structure; loose, nonsticky and nonplastic consistence; 5 percent gravel by volume; very strongly acid (pH 5.0); abrupt smooth boundary.
C3	15-19 cm (6-7 in)	Very dark gray (5Y 3/1) coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 5 percent gravel by volume; strongly acid (pH 5.5); abrupt smooth boundary.
C4	19-25 cm (7-10 in)	Very dark gray (5Y 3/1) sand; single grain structure; loose, nonsticky and nonplastic consistence; medium acid (pH 6.0); abrupt wavy boundary.
C5	25-33 cm (10-13 in)	Olive gray (5Y 4/2) silt loam; many, medium, distinct, dark brown (7.5YR 3/2) mottles; massive structure; friable, slightly sticky and slightly plastic; strongly acid (pH 5.5); abrupt smooth boundary.
C6	33-43 cm (13-17 in)	Black (5Y 2.5/2) sand; single grain structure; loose, nonsticky and nonplastic consistence; very strongly acid (pH 5.0); abrupt smooth boundary.
C7	43-68 cm (17-27 in)	Very dark gray (5Y 3/1) coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 70 percent rounded gravel by volume; strongly acid (pH 5.5); abrupt smooth boundary.
C8	68-81 cm (27-32 in)	Black (5Y 2.5/1) sand; single grain structure; loose, nonsticky and nonplastic consistence; strongly acid (pH 5.5); abrupt smooth boundary.

C9	81-90 cm (32-35 in)	Dark gray (5Y 4/1) silt loam; massive structure; friable, slightly sticky and slightly plastic consistence; medium acid (pH 6.0); abrupt wavy boundary.
C10	90-105 cm (35-41 in)	Dark brown (10YR 3/3) fine sandy loam; massive structure; very friable, slightly sticky and slightly plastic consistence; slightly acid (pH 6.5).

Soil Number 14

Taxonomic Class: Typic Cryaquent, fragmental, mixed.

Typical Location: These soils are found adjacent to active stream channels mostly in the Low Relief Moraine with Outwash Plain (71), Low-lying Flood Plain (82), and Unvegetated Stream Channel (83) units on poorly drained sites with a high water table. The vegetative cover is mostly willow/alder with fireweed and grass and may be sparce in places.

Typical Pedon:

O	9-0 cm (4-0 in)	Undecomposed and decomposed organic material.
A1	0-5 cm (0-2 in)	Dark brown (7.5YR 3/2) loamy fine sand; weak, very fine granular to massive structure; friable, nonsticky and nonplastic consistence; medium acid (pH 5.8); abrupt smooth boundary.
C1	5-24 cm (2-9 in)	Dark gray (5Y 4/1) fine sandy loam; common, fine, distinct, dark yellowish brown (10YR 3/4) mottles; massive structure; friable, slightly sticky and slightly plastic consistence; medium acid (pH 5.9); abrupt smooth boundary.
C2	24-55 cm (9-22 in)	Very dark gray (5Y 3/1) very coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 75 percent gravel and 15 percent cobbles by volume; slightly acid (pH 6.5).

Soil Number 15

Taxonomic Class: Lithic Borofolist, dysic.

Typical Location: These soils are found mostly in the River Cut Sideslope into Bedrock (85) unit on somewhat poorly drained sites with seepages along the bedrock. The vegetative cover is predominantly mountain hemlock, some spruce and birch, with willow and crowberry.

Typical Pedon:

Oi	0-3 cm (0-1 in)	Leaves and matted grass.
Oe1	0-12 cm (0-5 in)	Very dusky red (2.5YR 2.5/2) mucky peat; greater than 67 percent fibers, 33 to 67 percent when rubbed; extremely acid (pH 4.4); abrupt wavy boundary.
Oe2	12-26 cm (5-10 in)	Black (5YR 2.5/1) mucky peat; greater than 33 percent fibers; 10 percent mineral content by volume; extremely acid (pH 4.2); abrupt smooth boundary.
R	26 cm (10 in)	Shale

Soil Number 16

Taxonomic Class: Typic Cryorthents, loamy-skeletal, mixed, non-acid.

Typical Location: These soils are found mostly in the High Elevation Valley Train (86) unit on poorly drained sites with a high water table. The vegetative cover is predominantly mountain hemlock, some spruce and birch, with willow and crowberry.

Typical Pedon:

O1	18-13 cm (7-5 in)	Moss, leaves and matted sedge.
O2	13-0 cm (5-0 in)	Black (5YR 2.5/1) sapric, decomposed organic material; slightly acid (pH 6.2); clear smooth boundary.
A1	0-12 cm (0-5 in)	Very dark gray (5YR 3/1) silt loam; moderate, very fine granular structure; friable, nonsticky and slightly plastic consistence; 5 percent gravel by volume; slightly acid (pH 6.2); clear wavy boundary.
C1	12-37 cm (5-15 in)	Brown to dark brown (7.5YR 4/2) loamy sand; single grain structure; very friable, nonsticky and nonplastic consistence; 40 percent fine gravel, 30 percent gravel and 5 percent cobbles; neutral (pH 7.0); gradual wavy boundary.
C2	37-68 cm (15-27 in)	Dark grayish brown (2.5Y 4/2) loam; 30 percent fine gravel, 30 percent gravel and 5 percent cobbles by volume; neutral (pH 7.0).

Soil Number 17

Taxonomic Class: Fluvaquentic Borosaprists, euic.

Typical Location: These soils are found mostly in the High Elevation Valley Train (86) unit on poorly drained slightly sloping sites with a high water table and are intermittently flooded. The vegetative cover is composed of grass, sedge sphagnum moss with some blueberry.

Typical Pedon:

Oi	0-5 cm (0-2 in)	Sphagnum, moss, and grass.
Oe	5-13 cm (2-5 in)	Black (5YR 2.5/1) mucky peat; about 25 percent fibers, 10 percent when rubbed; strongly acid (pH 5.2); clear smooth boundary.
C1	13-20 cm (5-8 in)	Dark reddish gray (5YR 4/2) silt (ash); weak, fine granular structure; friable, slightly sticky and nonplastic consistence; strongly acid (pH 5.2); clear smooth boundary.
Oa1	20-82 cm (8-32 in)	Dark reddish brown (5YR 2.5/2) broken face to black (5YR 2.5/1) when pressed, muck; about 35 percent fibers, less than 5 percent when rubbed; medium acid (pH 6.0); clear smooth boundary.
Oa2	82-110 cm (32-43 in)	Dark reddish brown (5YR 3/2) broken face to dark reddish brown (5YR 3/3) when pressed, muck; about 80 percent fibers, about 15 percent when rubbed; slightly acid (pH 6.2); clear smooth boundary.

C2	110-137 cm (43-54 in)	Brown to dark brown (10YR 4/3) silt; massive structure; friable, nonsticky and slightly plastic consistence; neutral (pH 7.0).

Soil Number 18

Taxonomic Class: Entic Cryumbrepts, loamy-skeletal, mixed.

Typical Location: These soils are found mostly in the Alluvial and Till Bench (87) unit on somwhat gently sloping poorly drained sites with a high water table. The vegetative cover is composed of alder, currant, horsetail and club moss.

Typical Pedon:

O1	20-8 cm (8-3 in)	Leaves, needles, dead grass and forbs.
O2	8-0 cm (3-0 in)	Decomposed organic material; sapric; medium acid (pH 6.0); abrupt wavy boundary.
B2	0-31 cm (0-12 in)	Very dark grayish brown (10YR 3/2) sandy loam; weak, medium subangular blocky structure; friable, slightly sticky and slightly plastic consistence; 10 percent cobbles by volume; medium acid (pH 6.0); clear wavy boundary.
B3	31-49 cm (12-19 in)	Dark grayish brown (10YR 4/2) loam; massive structure; friable, slightly sticky and slightly plastic consistence; 10 percent gravel and 25 percent cobbles by volume; medium acid (pH 6.0); gradual wavy boundary.
C1	49-68 cm (19-27 in)	Dark grayish brown (2.5Y 4/2) clay loam; massive structure; firm, sticky and plastic consistence; 30 percent gravel and 10 percent cobbles by volume; medium acid (pH 6.0).

Soil Number 19

Taxonomic Class: Dystric Cryochrepts, coarse-loamy over sandy-skeletal, mixed.

Typical Location: These soils are found mostly in the Alluvial and Till Bench (87) unit on moderately well drained sites of former stream channels and in the higher elevations. The vegetative cover is composed of willow and blueberry with fireweed and grasses.

Typical Pedon:

O1	9-3 cm (3-1 in)	Leaves, matted forbs and grass.
O2	3-0 cm (1-0 in)	Decomposed organic materials; abrupt smooth boundary.
A11	0-5 cm (0-2 in)	Very dark grayish brown (10YR 3/2) silt loam; moderate, very fine granular structure; very friable, slightly sticky and nonplastic consistence; medium acid (pH 5.8); abrupt wavy boundary.
A12	5-7 cm (2-3 in)	Black (5YR 2.5/1) silt loam; weak, very fine granular structure; very friable, slightly sticky and nonplastic; medium acid (pH 5.8); abrupt wavy boundary.

B21	7-20 cm (3-8 in)	Dark grayish brown (10YR 4/2) silt loam; moderate, fine granular structure; friable, slightly sticky and nonplastic consistence; medium acid (pH 6.0); clear smooth boundary.
B22	20-32 cm (8-13 in)	Dark grayish brown (2.5Y 4/2) silt loam; weak, fine granular structure; friable, slightly sticky and nonplastic consistence; slightly acid (pH 6.4); abrupt smooth boundary.
C1	32-68 cm (13-27 in)	Very dark gray (5Y 3/1) sand; massive structure; loose, nonsticky and nonplastic consistence; 20 percent fine gravel and 50 percent gravel by volume; neutral (pH 6.6); abrupt smooth boundary.
C2	68-75 cm (27-30 in)	Olive gray (5Y 4/2) sandy loam; massive structures; firm, slightly sticky and slightly plastic consistence; 10 percent fine gravel and 30 percent cobbles by volume; neutral (pH 6.8); clear smooth boundary.
C3	75-80 cm (30-31 in)	Dark gray (5Y 4/1) sandy loam; massive structure; loose, nonsticky and nonplastic consistence; 25 percent fine gravel and 15 percent cobbles by volume; neutral (pH 6.8).

Soil Number 20

Taxonomic Class: Typic Cryaquents, fine-loamy, mixed, non-acid.

Typical Location: These soils are found mostly in the Alluvial and Till Bench (87) unit on somewhat poorly drained gently sloping sites with a high water table and ground water seeps due to very slowly permeable soil layers. The vegetative cover is composed of alder, rusty menziesia and blueberry with horsetail and grass.

Typical Pedon:

O1	28-25 cm (11-10 in)	Leaves, needles, horsetail and moss.
O2	25-0 cm (10-0 in)	Decomposed organic material; sapric.
A1	0-10 cm (0-4 in)	Very dark grayish brown (10YR 3/2) silt loam; weak, fine granular to massive structure; very friable, slightly sticky and nonplastic; neutral (pH 6.9); abrupt wavy boundary.
B3	10-17 cm (4-7 in)	Dark reddish brown (5YR 3/3) loam; massive structure, very friable, slightly sticky and slightly plastic consistence; 5 percent gravel by volume; neutral (pH 6.9); clear wavy boundary.
Cg	17-55 cm (7-22 in)	Dark gray (N 4/0) with inclusions of bluish gray (5B 5/1) silty clay loam; massive structure; firm, sticky and plastic consistence; 5 percent gravel and 25 percent cobbles by volume; neutral (pH 7.0).

Soil Number 21

Taxonomic Class: Typic Borosaprists, euic.

Typical Location: These soils are found in small muskegs in the Alluvial and Till Bench (87) unit on poorly drained sites with a high water table. The vegetative cover is composed of a thick moss carped with an open cover of spruce, alder and horsetail.

Typical Pedon:

Oi	0-6 cm (0-2 in)	Needles, cones, bark and moss; mildly alkaline (pH 7.5); gradual smooth boundary.
Oe	6-18 cm (2-7 in)	Black (7.5YR 2/0) broken face to black (5YR 2.5/1) when pressed, peaty muck; about 45 percent fibers, 20 percent when rubbed; neutral (pH 7.2); gradual smooth boundary.
Oa1	18-35 cm (7-14 in)	Black (5YR 2.5/1) broken face to black (7.5YR 2/0) when pressed, mucky peat; about 20 percent fibers, less than 5 percent when rubbed; neutral (pH 7.0); gradual smooth boundary.
Oa2	35-56 cm (14-22 in)	Dark brown (7.5YR 3/2) mucky peat; about 35 percent fibers, less than 5 percent when rubbed; slightly acid (pH 6.2); gradual smooth boundary.
Oa3	56-114 cm (22-45 in)	Dark reddish brown (5YR 2.5/2) broken face to black (5YR 2.5/1) when pressed, mucky peat; about 20 percent fibers, 2 percent when rubbed; slightly acid (pH 6.2) abrupt smooth boundary.
C	114 cm (45 in)	Mineral soil material.

Soil Number 22

Taxonomic Class: Typic Cryorthents, fine-loamy, mixed non-acid.

Typical Location: These soils are found in former swales mostly in the Alluvial Terrace (88) unit on somewhat poorly drained sites with a vegetative cover composed of spruce and cottonwood with devil's club, currant, horestail and grasses.

Typical Pedon:

O1	25-18 cm (9-7 in)	Leaves, needles and dead forbs.
O2	18-0 cm (7-0 in)	Decomposed organic material; neutral (pH 6.8).
C1	0-6 cm (0-2 in)	Dark grayish brown (2.5Y 4/2) fine sandy loam; massive structure; friable, slightly sticky and nonplastic consistence; neutral (pH 6.6); abrupt wavy boundary.
C2	6-13 cm (2-5 in)	Dark reddish brown (5YR 2.5/2) silt loam; weak, fine granular structure; friable, slightly sticky and nonplastic consistence; neutral (pH 6.6); abrupt wavy boundary.
C3	13-21 cm (5-8 in)	Olive gray (5Y 4/2) loamy sand; massive structure; very friable, nonsticky and nonplastic consistence; neutral (pH 6.8); abrupt wavy boundary.
C4	21-38 cm (8-15 in)	Dark brown (7.5YR 3/2) silt loam; weak, fine granular structure; friable, slightly sticky and nonplastic consistence; neutral (pH 6.8); abrupt broken boundary.

C5	38-51 cm (15-20 in)	Olive gray (5Y 4/2) silt loam; many, medium distinct, brown to dark brown (7.5YR 4/4) mottles; massive structure; friable, slightly sticky and nonplastic consistence; neutral (pH 6.8); abrupt wavy boundary.
C6	51-61 cm (20-24 in)	Very dark grayish brown (10YR 3/2) loam; moderate, fine granular structure; friable, nonsticky and nonplastic consistence; neutral (pH 7.0); abrupt wavy boundary.
C7	61-80 cm (24-31 in)	Olive gray (5Y 4/2) silty clay loam; many, large, distinct, brown to dark brown (7.5YR 4/4) mottles; moderate, fine platy structure; firm, sticky and slightly plastic consistence; neutral (pH 7.0).

Soil Number 23

Taxonomic Class: Typic Cryorthents, sandy, mixed.

Typical Location: These soils are found mostly in the Alluvial Terrace (88) unit on moderately well drained nearly level sites with a vegetative cover composed of aspen, spruce and birch, with crowberry, lowbush cranberry and grasses.

Typical Pedon:

01	10-0 cm (4-0 in)	Needles, leaves, moss and decomposed organic material.
A2	0-6 cm (0-2 in)	Dark gray (10YR 4/1) loamy sand; common, medium, distinct, dark yellowish brown (10YR 4/4) mottles; friable, nonsticky and nonplastic consistence; very strongly acid (pH 4.5); clear wavy boundary.
C1	6-58 cm (2-23 in)	Dark brown (10YR 3/3) mixed in layers with olive gray (5Y 4/2) loamy fine sand; single grain structure; friable, nonsticky and nonplastic consistence; slightly acid (pH 6.1); abrupt smooth boundary.
C2	58-74 cm (23-29 in)	Very dark gray (5Y 3/1) sand; single grain structure; loose, nonsticky and nonplastic consistence; medium acid (pH 5.9); abrupt smooth boundary.
C3	74-93 cm (29-37 in)	Olive gray (5Y 4/2) fine sandy loam; massive structure; friable, slightly sticky and nonplastic consistence; medium acid (pH 5.7); clear smooth boundary.
C4	93-100cm (37-39 in)	Dark gray (5Y 4/1) loamy sand; massive structure; friable, nonsticky and nonplastic consistence; 5 percent gravel and 30 percent cobbles by volume; medium acid (pH 5.8).

Soil Number 24

Taxonomic Class: Typic Cryofluvents, coarse-loamy, mixed, non-acid.

Typical Location: These soils are found mostly in the Forested Outwash Plain (89) unit on moderately well drained slightly sloping sites with a vegetative cover composed of cottonwood and birch, some spruce and willow, with cow parsnip, horsetail, fireweed and grass.

Typical Pedon:

O1	5-4 cm (3-2 in)	Leaves, needles and dead forbs.
O2	4-0 cm (2-0 in)	Decomposed organic material.
A1	0-9 cm (0-4 in)	Very dark grayish brown (10YR 3/2) loam; strong, fine granular; very friable, slighly sticky and slightly plastic consistence; 5 percent gravel by volume; medium acid (pH 5.6); clear wavy boundary.
C1	9-13 cm (4-5 in)	Dark grayish brown (2.5Y 4/2) loam; very friable, slightly sticky and slightly plastic consistence; 5 percent gravel by volume; medium acid (pH 5.8); clear wavy boundary.
C2	13-40 cm (5-16 in)	Very dark grayish brown (5Y 3/2) silty clay loam; faint mottles; moderate, fine subangular blocky structure; friable, sticky and plastic consistences; strongly acid (pH 5.4); abrupt wavy boundary.
C3	40-52 cm (16-20 in)	Very dark gray (10YR 3/1) silt loam; massive structure; very friable, nonsticky and nonplastic consistence; 2 percent gravel by volume; very strongly acid (pH 4.8); abrupt wavy boundary.
C4	52-80 cm (20-31 in)	Olive gray (5Y 5/2) sandy clay loam; weak, fine platy structure; friable, sticky and plastic consistence; medium acid (pH 5.6).

Soil Number 25

Taxonomic Class: Aquic Cryofluvents, sandy, mixed, non-acid.

Typical Location: These soils are found mostly in the Forested Outwash Plain (89) unit on somewhat poorly drained slightly sloping sites with vegetative cover composed of spruce, cottonwood and birch, along with salmonberry, devil's club and grass.

Typical Pedon:

O1	18-15 cm (7-6 in)	Leaves, needles, motted grass and forbs.
O2	15-0 cm (6-0 in)	Decomposed organic material.
C1	0-38 cm (0-15 in)	Dark grayish brown (10YR 4/2) loamy fine sand; many, medium, fine, very dark grayish brown (10YR 3/2) mottles; single grain structure; very friable, nonsticky and nonplastic consistence; less than 5 percent gravel by volume; medium acid (pH 5.8); gradual wavy boundary.
C2	38-80 cm (15-31 in)	Very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) loamy sand; single grain structure; very friable, nonsticky and nonplastic consistence; 10 percent fine gravel by volume; medium acid (pH 6.0); gradual wavy boundary.
C3	80-110 cm (31-43 in)	Very dark gray (10YR 3/1) sand; single grain structure; loose, nonsticky and nonplastic; consistence; 70 percent gravel and 5 percent cobbles by volume; medium acid (pH 6.0).

Soil Number 26

Taxonomic Class: Lithic Cryochrepts, sandy-skeletal, mixed.

Typical Location: These soils are found mostly in the Non-forested Ice Scoured Land (101) unit on well drained steeply sloping sites shallow to bedrock. The vegetative cover is composed of sparse scattered mountain hemlock with heather, anemone, crowberry and sedge.

Typical Pedon:

Ol	4-0 cm (2-0 in)	Heather, leaves and sedge.
A1	0-7 cm (0-3 in)	Dark reddish brown (5YR 3/3) fine sandy loam; weak, fine granular structure; very friable, nonsticky and slightly plastic consistence; very strongly acid (pH 5.0); clear smooth boundary.
B2	7-19 cm (3-7 in)	Dark reddish brown (5YR 3/4) sandy loam; weak, fine granular structure; friable, slightly sticky and slightly plastic consistence; 15 percent gravel by volume; very strongly acid (pH 5.0); clear smooth boundary.
C	19-38 cm (7-15 in)	Dark brown (7.5YR 3/2) coarse sand; massive structure; loose, nonsticky and nonplastic consistence; 50 percent fine gravel and 5 percent gravel by volume; medium acid (pH 5.8); abrupt irregular boundary.
R	38 cm (15 in)	Metasandstone

Soil Number 27

Taxonomic Class: Lithic Borohemists, euic, shallow.

Typical Location: These soils are found in muskegs mostly in the Non-forested Ice Scoured Land (101) unit on very poorly drained slightly sloping sites with a high water table. The vegetative cover consists of sparse black spruce with bog blueberry, dwarf birch, shrubby cinquefoil and mosses.

Typical Pedon:

Oi1	0-2 cm (0-1 in)	Moss and needles.
Oi2	2-14 cm (1-6 in)	Dark reddish brown (5YR 3/3) broken face to reddish brown (5YR 4/3) when pressed, peat; about 100 percent fibers, 95 percent when rubbed; strongly acid (pH 5.5); clear, smooth boundary.
Oa	14-30 cm (6-12 in)	Black (5YR 2.5/1) muck; about 40 percent fibers, 15 percent when rubbed; neutral (pH 7.0); abrupt smooth boundary.
R	30 cm (12 in)	Metasandstone.

Soil Number 28

Taxonomic Class: Humic Cryorthod, sandy-skeletal, mixed.

Typical Location: These soils are found mostly in the Forested Ice Scoured Land (102) unit on well drained steeply sloping sites with a vegetative cover of mountain hemlock and spruce with blueberry, five-leaf bramble and mosses.

Typical Pedon:

01	22-12 cm (9-5 in)	Needles, cones, twigs, rotten wood and moss.
02	12-0 cm (5-0 in)	Decomposed organic material.
A2	0-6 cm (0-2 in)	Dark grayish brown (10YR 4/2) silt loam; weak very fine subangular blocky structure; friable, slightly sticky and plastic consistence; extremely acid (pH 4.0); abrupt smooth boundary.
B21h	6-17 cm (2-7 in)	Black (5YR 2.5/1) loamy sand to sandy loam; moderate, coarse, subangular blocky structure; friable, slightly sticky and slightly plastic consistence; 10 percent gravel by volume; extremely acid (pH 4.2); clear irregular boundary.
B22ir	17-27 cm (7-11 in)	Dark reddish brown (5YR 3/2) loamy sand to sandy loam; weak, medium, subangular blocky structure; very friable, slightly sticky and slightly plastic consistence; 10 percent gravel by volume; very strongly acid (pH 4.5); gradual wavy boundary.
C1	27-43 cm (11-17 in)	Very dark gray (10YR 3/1) sand; single grain structure; loose, nonsticky and nonplastic consistence; 20 percent gravel by volume; medium acid (pH 6.0); clear smooth boundary.
C2	43-63 cm (17-25 in)	Very dark gray (10YR 3/1) very coarse sand; single grain structure; loose, nonsticky and nonplastic consistence; 50 to 75 percent gravel by volume with depth; slightly acid (pH 6.5).

Soil number 29

Taxonomic Class: Lithic Cryorthods, coarse-loamy, mixed.

Typical Location: These soils are found mostly in the Forested Ice Scoured Land (102) unit on moderately well drained moderately sloping sites with a vegetative cover of mixed spruce, hemlock and birch with rusty menziesia, crowberry and lowbush cranberry.

Typical Pedon:

01	10-5 cm (4-2 in)	Needles, cones, twigs, leaves and moss.
02	5-0 cm (2-0 in)	Decomposed organic material.

A2	0-7 cm (0-3 in)	Dark grayish brown (10YR 4/2) loam; moderate, fine granular structure; friable, slightly sticky and plastic consistence; 10 percent gravel by volume; very strongly acid (pH 4.5); clear wavy boundary.
B21ir	7-22 cm (3-9 in)	Dark reddish brown (5YR 3/2) sandy loam; weak, fine granular structure; very friable, slightly sticky and slightly plastic consistence; 10 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.5); clear wavy boundary.
B22ir	22-32 cm (9-13 in)	Dark reddish brown (5YR 3/2) coarse sandy loam; weak, fine granular structure; very friable, slightly sticky and slightly plastic consistence; 40 percent gravel by volume; strongly acid (pH 5.5); clear wavy boundary.
B23ir	32-44 cm (13-17 in)	Dark brown (7.5YR 3/2) coarse sandy loam; weak, fine granular structure; very friable, nonsticky and slightly plastic consistence; 15 percent gravel by volume; strongly acid (pH 5.5).
R	44 cm (17 in)	Shale.

Soil Number 30

Taxonomic Class: Dystric Cryochrepts, sandy-skeletal, mixed.

Typical Location: These soils are found mostly in the Forested Ice Scoured Land (102) unit on well drained gently sloping sites shallow to bedrock. The vegetative cover is composed of spruce, some mountain hemlock and birch, with alder, elderberry, ferns and grasses.

Typical Pedon:

01	31-8 cm (12-3 in)	Spagnum moss, leaves and needles; fibric.
02	8-0 cm (3-0 in)	Decomposed organic material; hemic.
A2	0-9cm (0-4 in)	Very dark gray (10YR 3/1) fine sandy loam; weak, fine subangular blocky structure; friable, slightly sticky and slightly plastic consistence; extremely acid (pH 4.3); abrupt broken boundary.
B21ir	9-18 cm (4-7 in)	Dark reddish brown (5YR 3/3) loamy coarse sand; weak, fine granular structure; very friable, nonsticky and nonplastic consistence; 30 percent gravel by volume; very strongly acid (pH 4.5); abrupt wavy boundary.
B22	18-28 cm (7-11 in)	Very dark grayish brown (10YR 3/2) loamy coarse sand; weak, fine granular structure; very friable, nonsticky and nonplastic consistence; 40 percent gravel and 10 percent cobbles by volume; very strongly acid (pH 5.0); abrupt wavy boundary.
B3	28-44 in (11-17 in)	Dark brown (10YR 3/3) loamy coarse sand; weak, fine granular structure; very friable, nonsticky and nonplastic consistence; 50 percent gravel and 20 percent cobbles by volume; very strongly acid (pH 5.0); abrupt wavy boundary.

C	44-72 cm (17-28 in)	Dark grayish brown (2.5Y 4/2) loamy coarse sand; moderate, fine granular structure; very friable, nonsticky and nonplastic consistence; 60 percent gravel and 20 percent cobbles by volume; strongly acid (pH 5.5).
R	72 cm (28 in)	Shale.

Soil Number 31

Taxonomic Class: Typic Cryumbrepts, loamy-skeletal, mixed.

Typical Location: These soils are of limited range being found mostly in the following units: Early Stage Breakland (111), Mid-Stage Breakland (112), and Late Stage Breakland (113). They are found mostly on slopes greater than 45 percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material. The vegetative cover is mostly shrub willow, spirea and low juniper with oakfern, fireweed, bluejoint grass and some alpine type plants.

Typical Pedon:

01	10-0 cm (4-0 in)	Dead moss and grass.
A11	0-17 cm (0-7 in)	Dark reddish brown (5YR 3/2) silt loam; weak, very fine granular structure; very friable, nonsticky and slightly plastic consistence; very strongly acid (pH 4.8); clear wavy boundary.
A12	17-38 cm (7-15 in)	Dark reddish brown (5YR 2.5/2) silt loam; moderate, very fine granular structure; very friable, nonsticky and slightly plastic consistence; 5 percent fine gravel and 10 percnt gravel by volume; medium acid (pH 5.7); abrupt wavy boundary.
B21	38-66 cm (15-25 in)	Dark brown (7.5YR 3/2) loamy sand; single grain structure; loose, nonsticky and nonplastic consistence; 30 percent fine gravel, 15 percent gravel and 15 percent cobbles by volume; medium acid (pH 6.0); clear wavy boundary.
B22	66-89 cm (25-35 in)	Dark reddish brown (5YR 3/3) silt loam; weak, fine granular to subangular blocky structure; friable, slightly sticky and nonplastic consistence; 25 percent gravel and 15 percent cobbles by volume; medium acid (pH 6.0); clear wavy boundary.
C	89-101 cm (35-40 in)	Dark reddish brown (5YR 3/4) sandy loam; single grain structure; friable, nonsticky and nonplastic consistence; 20 percent fine gravel, 15 percent gravel and 40 percent cobbles by volume; medium acid (pH 6.0); abrupt wavy boundary.
R	101 cm (40 in)	Slate and metasandstone.

Soil Number 32

Taxonomic Class: Lithic Cryochrepts, loamy-skeletal, mixed.

Typical Location: These soils are of limited range being found mostly in the following units: Mid-stage Breakland (112), Late Stage Breakland (113), and Headlands (114). They are found mostly on slopes greater than 45

percent and are influenced greatly by frost heaving and colluvial downslope movement of loose rock material. The vegetative cover is mostly alpine bearberry, alpine saxifrage, anemone, crowberry and grasses with some other alpine type plants.

Typical Pedon:

Ol	5-0 cm (2-0 in)	Dead leaves and grass.
A1	0-7 cm (0-3 in)	Black (5YR 2.5/1) loam; weak, very fine granular structure; friable, nonsticky and nonplastic consistence; 35 percent fine gravel, 5 percent gravel and 15 percent cobbles by volume; very strongly acid (pH 5.0); clear wavy boundary.
B2	7-26 cm (3-10 in)	Dark reddish brown (5YR 3/2) loam; moderate, very fine granular structure; friable, nonsticky and nonplastic consistence; 20 percent fine gravel, 25 percent gravel and 10 percent cobbles by volume; very strongly acid (pH 5.0); clear wavy boundary.
C	26-49 cm (10-20 in)	Dark brown (7.5YR 3/2) loam; single grain structure; friable, nonsticky and nonplastic consistence; 20 percent fine gravel, 25 percent gravel and 10 percent gravel by volume; strongly acid (pH 5.3); abrupt irregular boundary.
R	49 cm (20 in)	Slate and metasandstone

Soil Number 33

Taxonomic Class: Sapric Borohemist, euic.

Typical Location: These soils are found mostly in muskegs in the Forested Ice Scoured Land (102) unit on poorly drained, very gently sloping sites with a moderately high water table. The vegetative cover consists of sparce clumps of black spruce, some dwarf birch and blueberry, with labrador tea, sphagnum moss and other muskeg plants.

Typical Pedon:

Oi1	0-2 cm (0-1 in)	Moss, leaves and needles.
Oi2	2-21 cm (1-8 in)	Reddish brown (5YR 4/4) broken face to brown (7.5YR 5/4) when pressed, peat; about 100 percent fibers, greater than 66 percent when rubbed; extremely acid (pH 4.1); clear smooth boundary.
Oi3	21-35 cm 8-13 in)	Dark reddish brown (5YR 3/3) broken face to reddish brown (5YR 4/4) when pressed, peat; about 80 percent fibers, greater than 66 percent when rubbed; very strongly acid (pH 4.6); abrupt smooth boundary.
Oe1	35-49 cm (13-19 in)	Dark reddish brown (5YR 3/2) broken face to dark reddish brown (5YR 2.5/2) when pressed, peaky muck; greater than 66 percent fiber, 33 to 66 percent when rubbed; medium acid (pH 5.6); clear smooth boundary.
Oe2	49-99 cm (19-39 in)	Dark reddish brown (5YR 3/3) mucky peat; greater than 66 percent fiber, about 33 percent when rubbed; strongly acid (pH 5.3); clear smooth boundary.

Oa	99-130 cm (39-51 in)	Dark reddish brown (5YR 3/2) broken face to dark reddish brown (5YR 2.5/2) when pressed, muck; less than 66 percent fiber, less than 33 percent when rubbed; very strongly acid (pH 5.0).

APPENDIX E

LIST OF PLANT SPECIES

Common and Botanical Names

Common Name	Botanical Name (7)
Alder	Alnus spp.
Alpine azalea	Loiseleuria procumbens
Alpine bearberry	Arctostaphylos alpina
Alpine saxifrage	Saxifraga nivalis
Anemone	Anemone spp.
Birch	Betula spp.
Black Cottonwood	Populus trichocarpa
Black Spruce	Picea marina
Blueberry	Vaccinium spp.
Bluegrass	Poa spp.
Bluejoint grass	Calamagrostis canadensis
Bog cranberry	Vaccinium uliginosum
Bunchberry	Cornus canadensis
Bunch grass	Hierochloe alpina
Clubmoss	Lycopodium spp.
Cottonwood	Populus spp.
Cow parsnip	Heracleum lanatum
Crowberry	Empetrum nigrum
Currant	Ribes spp.
Devil's club	Oplopanax horridum
Dwarf birch	Betula nana
Dwarf willow	Salix reticulata
Elderberry	Sambucus racemosa
Fireweed	Epilobium angustifolium
Five-leaf bramble	Rubus pedatus
Geranium	Geranium erianthum
Ground blueberry	Vaccinium spp.
Heather	Cassiope stelleriana
Hemlock	Tsuga spp.
Horsetail	Equisetum spp.
Laborador tea	Ledum palustre
Lowbush cranberry	Vaccinium vitis-idaea
Low juniper	Juniperus communis
Luetkea	Luetkea pectinata
Mountain hemlock	Tsuga mertensiana
Nagoonberry	Rubus arcticus
Oak fern	Gymnocarpium dryopteris
Paper birch	Betula papyrifera
Prickly rose	Rosa acicularis
Quaking aspen	Populus tremuloides
Red elderberry	Sambucus racemosa
Reindeer moss	Peltigera and Cladonia
Rusty menziesia	Menziesia ferruginea
Salmonberry	Rubus spectabilis
Sandwort	Minuartia spp.
Sedge	Carex spp.
Shield fern	Dryopteris fragrans
Shrubby cinquefoil	Potentilla fruticosa
Shrub willow	Salix spp.
Sitka alder	Alnus sinuata
Sitka burnet	Sanguisorba stipulata and menziesii

Sitka spruce	*Picea sitchensis*
Sphagnum moss	*Sphagnum spp.*
Spirea	*Spiraea beauverdiana*
Spruce	*Picea spp.*
Sweetgale	*Myrica gale*
Thinleaf alder	*Alnus tenuifolia*
Twisted stalk	*Streptopus amplexiflorus*
Vetch	*Lathyrus palustris*
Western hemlock	*Tsuga heterophylla*
White spruce	*Picea glauca*
Willow	*Salix spp.*
Wintergreen	*Pyrola spp.*
Wood fern	*Dryopteris dilatata*

APPENDIX III

GLOSSARY (9,11,12,14)

Alluvial	General term pertaining to material or processes associated with transportation or deposition by running water.
Alluvial fan	A body of alluvium whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a plain.
Alluvium	Unconsolidated material deposited on land by running water includig gravel, sand, silt, clay and various mixtures of these.
Argillite	A rock derived from siltstone, claystone, or shale, that has undergone a somewhat higher degree of heat and pressure.
Bedrock	The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
Bench	A nearly level to gently inclined erosional surface developed on resistant strata occurring along valley sides.
Boulders	Rock fragments greater than 60 cm (24 in) in diameter.
Chert	A compact, siliceous rock mainly of either organic or precipitated origin.
Clay	A soil separate consisting of particles less than .002 mm in diameter (see soil separates). A soil textural class containing large amounts of clay with smaller amounts of sand and silt (see soil textures).
Coarse Fragments	Rock or mineral fragments having a diameter of 2 mm or more; gravel, cobbles, stones and boulders.
Cobbles	Rounded or partly rounded fragments of rock 7.5 to 2.5 cm (3 to 10 in) in diameter.
Colluvium	A general term applied to loose deposits of rock and soil at the base of cliffs or the bottom of hills that was deposited mainly by gravitational forces.
Compact glacial till	Glacial drift deposited beneath a moving glacier, commonly clay rich, characterized by an extremely dense structure. Well-fitted till has less of a dense structure in place. This soil will restrict the movement of water through it relative to the degree of compaction.
Conglomerate	A cemented rock containing rounded fragments of gravel or pebbles.
Fibric soil material (peat)	The least decomposed of all organic soil material. Fibric peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Fibric peat has the lowest bulk density and the highest water content at saturation of all organic soil material. Greater than two-thirds of the soil has visible fibers.
Forb	Any herbaceous plant that is not a grass or a sedge.

Flood plain	A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.
Glacial till	Nonsorted and nonstratified glacial drift; generally unconsolidated which has been transported and deposited directly by the ice without subsequent reworking by water from the glacier; and consisting of a heterogeneous mixture of clay through boulder size particles.
Granodiorite	An igneous rock which is similar to granite.
Gravel	Rounded or angular fragments of rock 2 mm to 7.5 cm (3 in) in diameter. An individual piece is a pebble.
Graywacke	A type of sandstone marked by large quartz grains set in a clay matrix and subjected to low-grade metamorphism.
Greenstone	An altered basic igneous rock which owes its color to chlorite, hornblende and epidote.
Hemic soil material (mucky peat, peaty muck)	Organic soil material intermediate in degree of decomposition between the less decomposed fibric and more decomposed sapric material. Between one and two-thirds of the soil has visible fibers.
Horizon, soil	A layer of soil approximately parallel to the land surface, having distinct characteristics produced by soil forming processes and differing from adjacent genetically related layers (horizons) in physical, chemical, and biological properties or characteristics.
Limestone	A bedded sedimentary rock consisting mainly of calcium carbonate.
Moraine	An accumulation of soil and rock material, built chiefly by the direct action of glacial ice, which has an initial topographic expression of its own that is independent of control by the surface on which it lies.
Muskeg	A common name applied to meadows of the generally timbered country which have very poorly drained organic soils derived from a sphagnum, sedge, grass and/or herbaceous mat. Often a few slow growing, poorly formed black spruce or mountain hemlock with heath shrubs, willows, and dwarf birches are scattered on the drier sites.
Outwash plain	An extensive lowland area of mainly sandy or coarse textured glacial outwash deposited by meltwater streams beyond the active glacial ice (glaciofluvial origin). An outwash plain is commonly smooth but where pitted it is generally low in relief.
Pedon	The smallest volume that can be called a soil. It can be described and sampled to represent the nature and arrangement of its horizons, variability and other properties that are preserved in the samples. It extends downward to the depth of roots and ranges from one to 10 square meters in size.
Reworked glacial till	Very weakly assorted and stratified glacial drift, unconsolidated, which have been worked by outwash water while and/or after being deposited.

Sand — A soil separate consisting of particles between .05 and 2.0 mm in diameter (see soil separates). A soil texture containing almost all sand with very little silt and/or clay (see soil textures).

Sapric soil material (muck) — The most highly decomposed of all organic soil material. Sapric muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material. Less than one-third of undisturbed soil has visible fibers.

Schist — A variety of microcyrstaline rocks with a variety of origins and compositions that have undergone metamorphism to result in a layered or laminar structure.

Silt — A soil separate consisting of particles between .002 to .05 mm in diameter (see soil separates). A soil textural class containing almost all silt with very little clay and/or sand (see soil textures).

Slate — A fine grain metamorphic rock with a well developed fissiled cleavage.

Soil — A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthly parent material; as conditioned by relief over periods of time.

Soil Depth — Deep - Soil which is greater than 100 cm (39 in) in depth.
Moderate - Soil which is between 50 to 100 cm (20 to 39 in) in depth.
Shallow - Soil which is less than 50 cm (20 in) in depth.

Soil Drainage — Refers to the frequency and duration of periods of saturation or partial saturation during soil formation. The following seven classes of natural soil drainage are recognized:

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or near the surface during most of the growing season, usually within 45 cm (18 in). Surface horizons are generally peat or muck. Very poorly drained soils usually occupy level or depressed areas and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Poorly drained - Water is removed so slowly that the soil periodically remains wet for prolonged intervals during the growing season. Poor drainage results from a high water table within 45 to 90 cm (18 to 36 cm) of the surface, a slowly permeable layer within the soil profile, nearly continuous rainfall, additional water from seepage, or a combination of these.

Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing season, but not all the time. There are usually thick and dark A soil horizons. Somewhat poorly drained soils commonly have a slowly previous layer, a high water table within 90-150 cm (35 to 60 in), additional water from seepage, nearly continuous rainfall, or a combination of these.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods causing the profile to be wet for a short but significant part of the growing season. There may be mottles in the B horizon or within 90 cm (36 in) of the soil surface. Moderately well drained soils commonly have a slowly previous layerwithin or directly below the solum, a relatively high or

intermittently high water table, receive additional water from seepage, periodically receive high rainfall, or a combination of these.

Well drained - Water is removed from the soil readily, but not rapidly, and is available throughout most of the growing season. Well drained soils are commonly medium textured. They are mainly free of mottling.

Somewhat excessively drained - Water is removed from the soil rapidly, or some soils are so steep that much of the water they receive is lost as runoff. Somewhat excessively drained soils are generally sandy and rapidly pervious with little horizon differentation. Some are shallow in depth. All are free of the mottling related to wetness.

Excessively drained - Water is removed from the soil very rapidly, or some soils are so steep that much water they recieve is lost as runoff. Excessively drained soils are commonly very coarse textured, rocky and extremely pervious with little horizon differentation. Some are shallow in depth. All are free of the mottling related to wetness.

Soil separates

Mineral particles less than 2 mm in diameter, ranging between specific size limits. The names and size limits are:

Sand - .05 to 2.0 mm
- Very coarse sand - 1.0 to 2.0 mm
- Coarse sand - .5 to 1.0 mm
- Medium sand - .25 to .5 mm
- Fine sand - .10 to .25 mm
- Very fine sand - .05 to .10 mm

Silt - .002 to .05 mm

Clay - less than .002 mm

Soil texture

The relative proportions of the various soil separates (sand, silt and clay) as described by the classes of soil texture. The limits of the various classes and subclasses are as follows:

Sands - Soil material that contains 85 percent or more of sand; percentage of silt, plus 1 1/2 times the percentage of clay, shall not exceed 15.

Coarse sand - 25 percent or more very coarse and coarse sand, and less than 50 percent any other one grade of sand.

Sand - 25 percent or more very coarse, coarse, and medium sand, and less than 50 percent fine or very fine sand.

Fine sand - 50 percent or more fine sand (or) less than 25 percent very coarse, coarse, and medium sand and less than 50 percent very fine sand.

Very fine sand - 50 percent or more very fine sand.

Loamy sands - Soil material that contains at the upper limit 85 to 90 percent sand, and the percentage of silt plus 1 1/2 times the percentage of clay is not less than 15; at the lower limit it contains not less than 70 to 85 percent sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Loamy coarse sand - 25 percent or more very coarse and coarse sand, and less than 50 percent any other one grade of sand.

Loamy sand - 25 percent or more very coarse, coarse, and medium sand, and less than 50 percent fine or very fine sand.

Loamy fine sand - 50 percent or more fine sand (or) less than 25 percent very coarse, coarse, and medium sand and less than 50 percent very fine sand.

Loamy very fine sand - 50 percent or more very fine sand.

Sandy loams - Soil material that contains either 20 percent clay or less, and the percentage of silt plus twice the percentage of clay exceeds 30, and 52 percent or more sand; or less than 7 percent clay, less than 50 percent silt, and between 43 percent and 52 percent sand.

Coarse sandy loam - 25 percent or more very coarse and coarse sand and less than 50 percent any other one grade of sand.

Sandy loam - 30 percent or more very coarse, coarse, and medium sand, but less than 25 percent very coarse sand, and less than 30 percent very fine or fine sand.

Fine sandy loam - 30 percent or more fine sand and less than 30 percent very fine sand (or) between 15 and 30 percent very coarse, coarse, and medium sand.

Very fine sandy loam - 30 percent or more very fine sand (or) more than 40 percent fine and very fine sand, at least half of which is very fine sand and less than 15 percent very coarse, coarse, and medium sand.

Loam - Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Silt loam - Soil material that contains 50 percent or more silt and 12 to 27 percent clay (or) 50 to 80 percent silt and less than 12 percent clay.

Silt - Soil material that contains 80 percent or more silt and less than 12 percent clay.

Sandy clay loam - Soil material that contains 20 to 35 percent clay, less than 28 percent silt, and 45 percent or more sand.

Clay loam - Soil material that contains 27 to 40 percent clay and 20 to 45 percent sand.

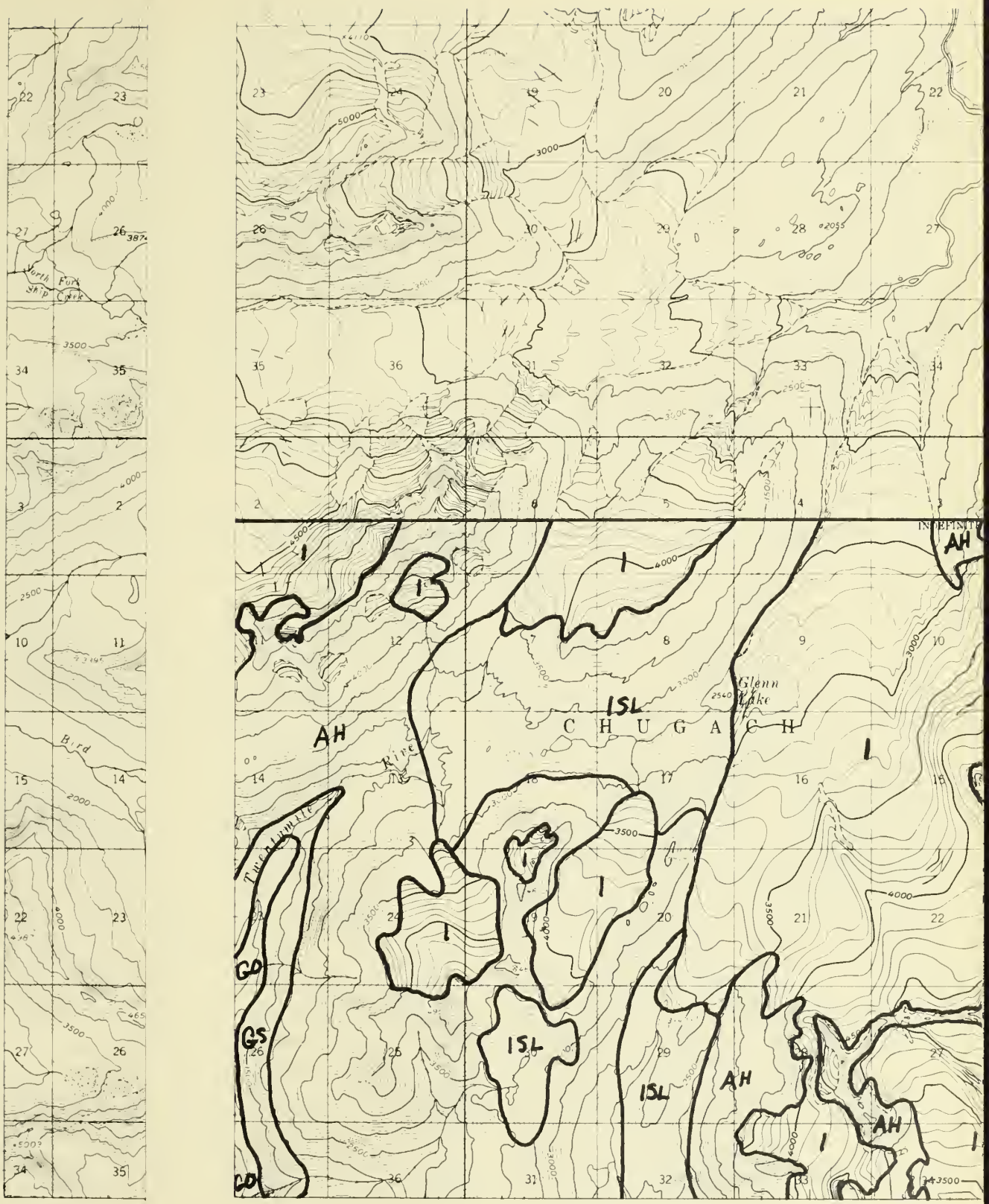
Silty clay loam - Soil material that contains 27 to 40 percent clay and less than 20 percent sand.

Sandy clay - Soil material that contains 35 percent or more clay and 45 percent or more sand.

Silty clay - Soil material that contains 40 percent or more clay and 40 percent or more silt.

Clay - Soil material that contains 40 or more clay, less than 45 percent sand, and less than 40 percent silt.

Solum	The upper and most weathered part of the soil profile in which the processes of soil formation are active; the A and B horizons.
Subsoil	Technically, the soil comprising the B horizon; roughly, the part of the solum below the surface soil.
Substratum	The part of the soil below the solum.
Stones	Rock fragments 25 to 60 cm (10 to 24 in) in diameter.
Stratified	Arranged in or composed of layers or strata. The term refers to geologic material. Layers in soil that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.
Talus	Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.
Terrace	A former alluvial plain, usually narrow and ordinarily flat or undulating which borders a valley floor or shoreline. The surface may be step-like representing the former position of an alluvial plain. A stream terrace, in contrast with a flood plain, is seldom subject to overflow.
U-shaped valley	The characteristic cross sectional appearance of a valley after it has been carved by a glacier.
Valley train	Glacial outwash sediments often linear in distribution which aggrade a valley bottom. They are usually in cross bedded units of sharply altering particle sizes and are frequently terraced.
V-notches	Deeply incised V-shaped drainages cut by stream action. They typically have very steep and unstable sideslopes.
V-shaped	The characteristic cross sectional appearance of a youthful valley after it has been down cut by running water.
Volcanic detritus	Material produced by the disintegration and weathering of volcanic rocks that have been moved from their site of origin.
Volcanic mafic	Dark colored minerals of volcanic origin.
Water table	The upper limit of the soil or underlying rock material that is wholly saturated with water.
Well-fitted glacial till	(See compact glacial till).



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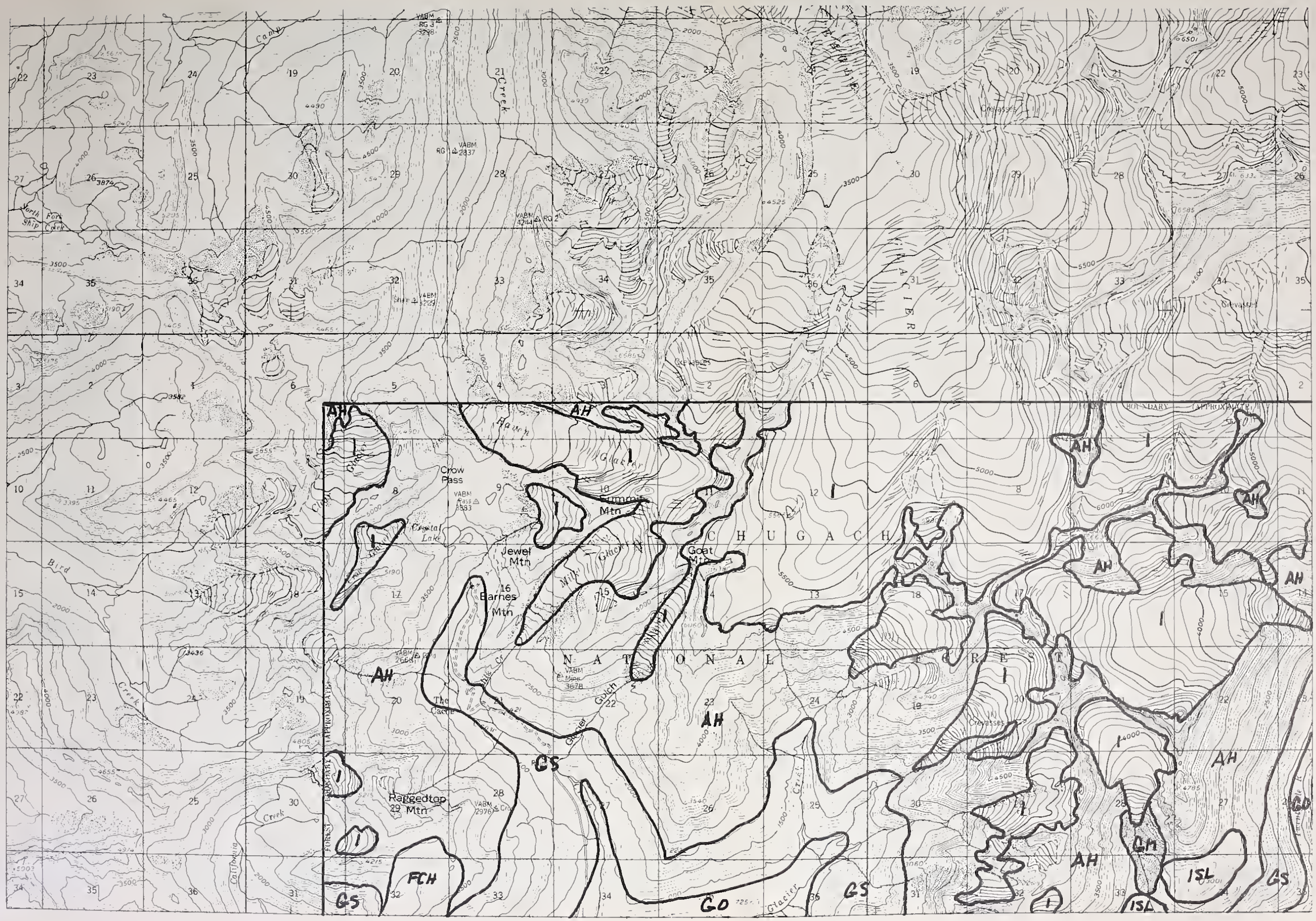

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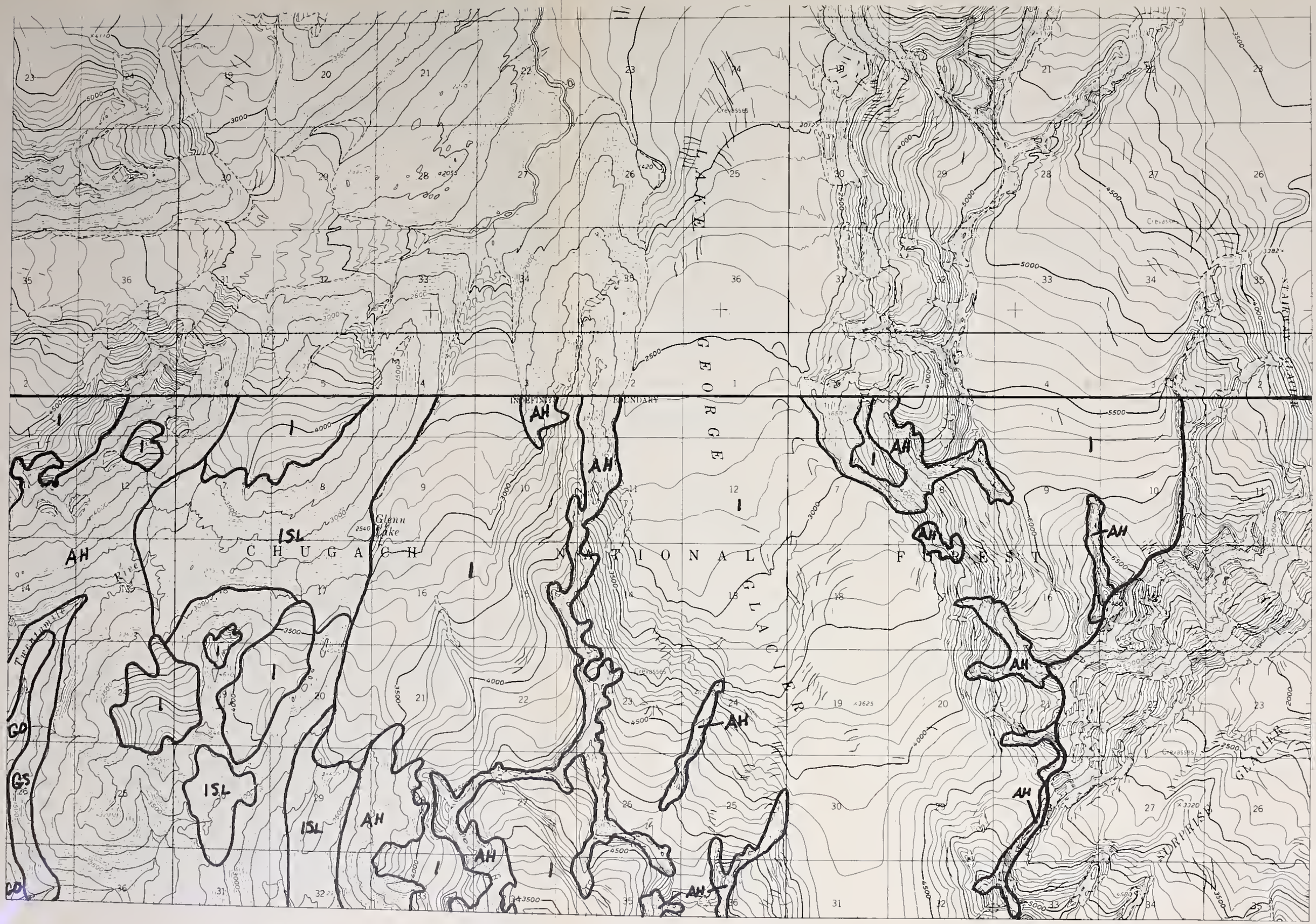

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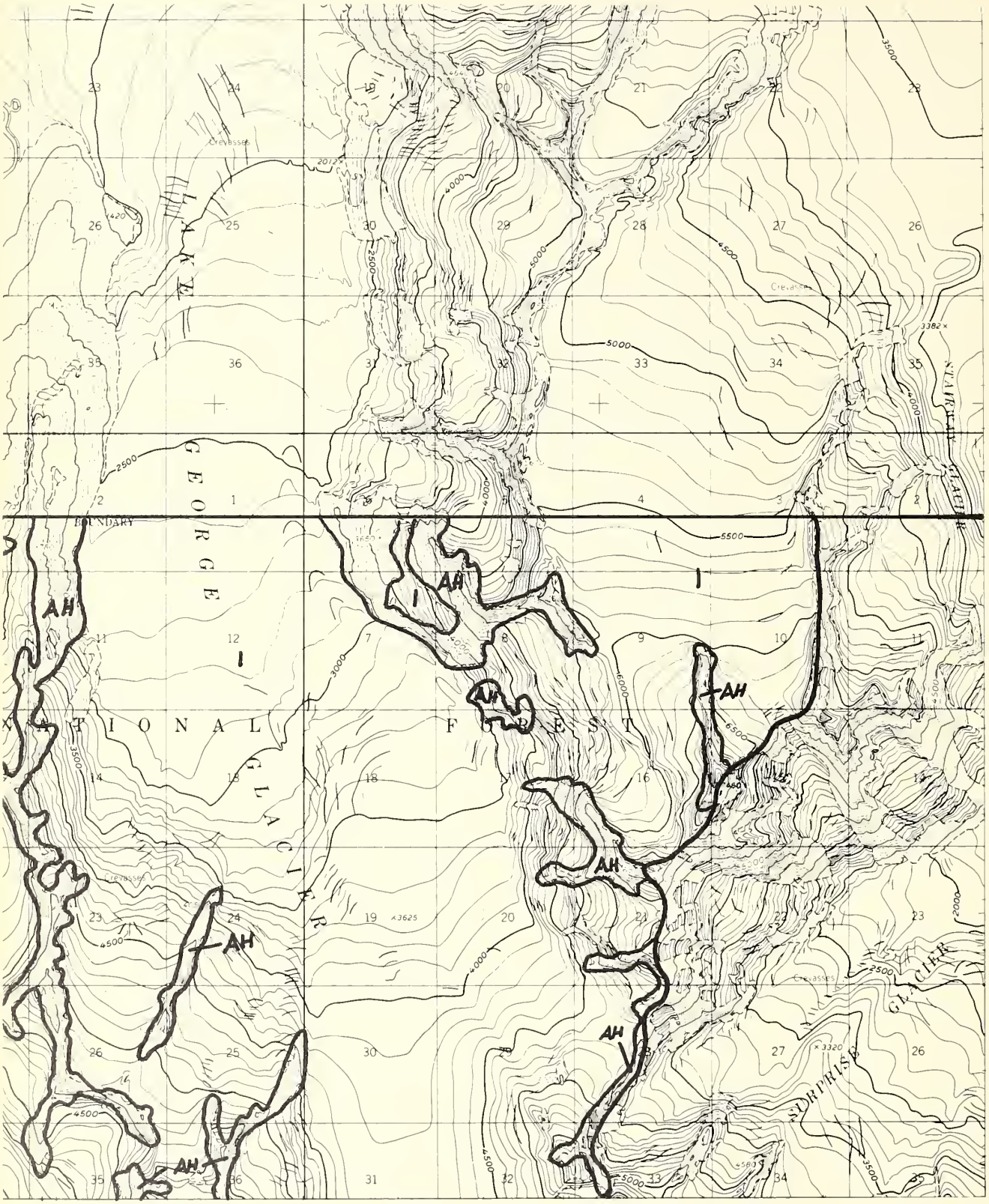
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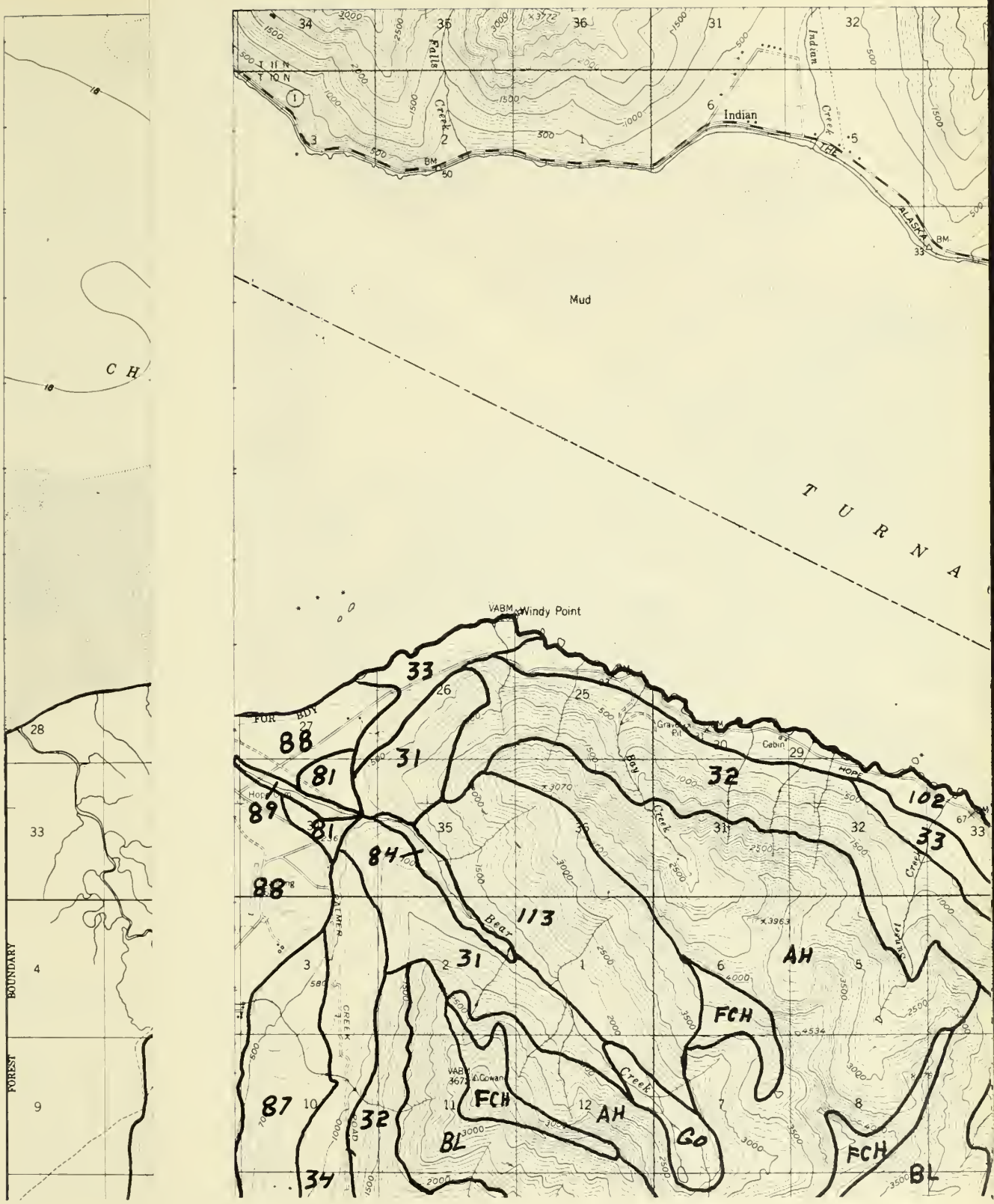

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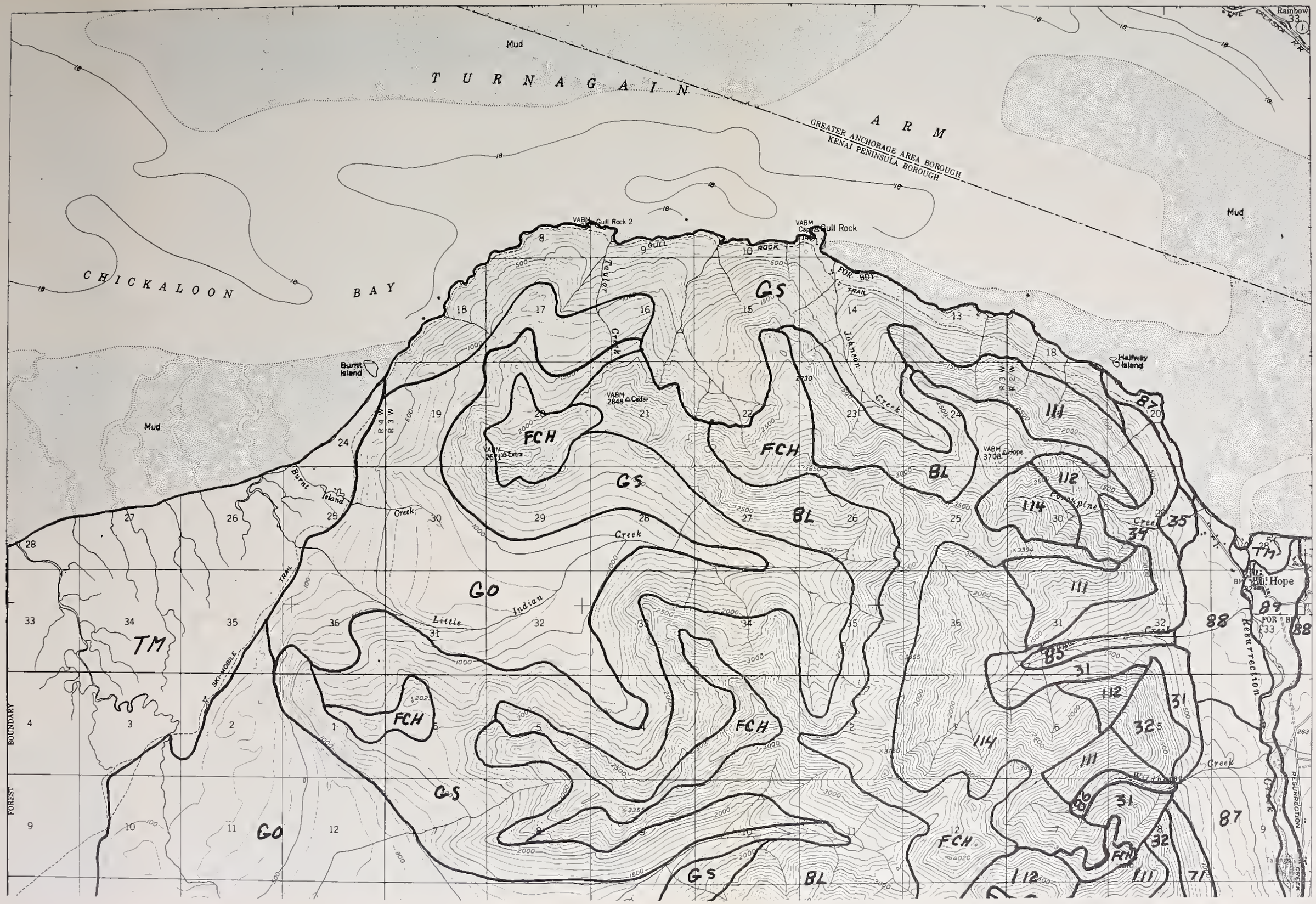

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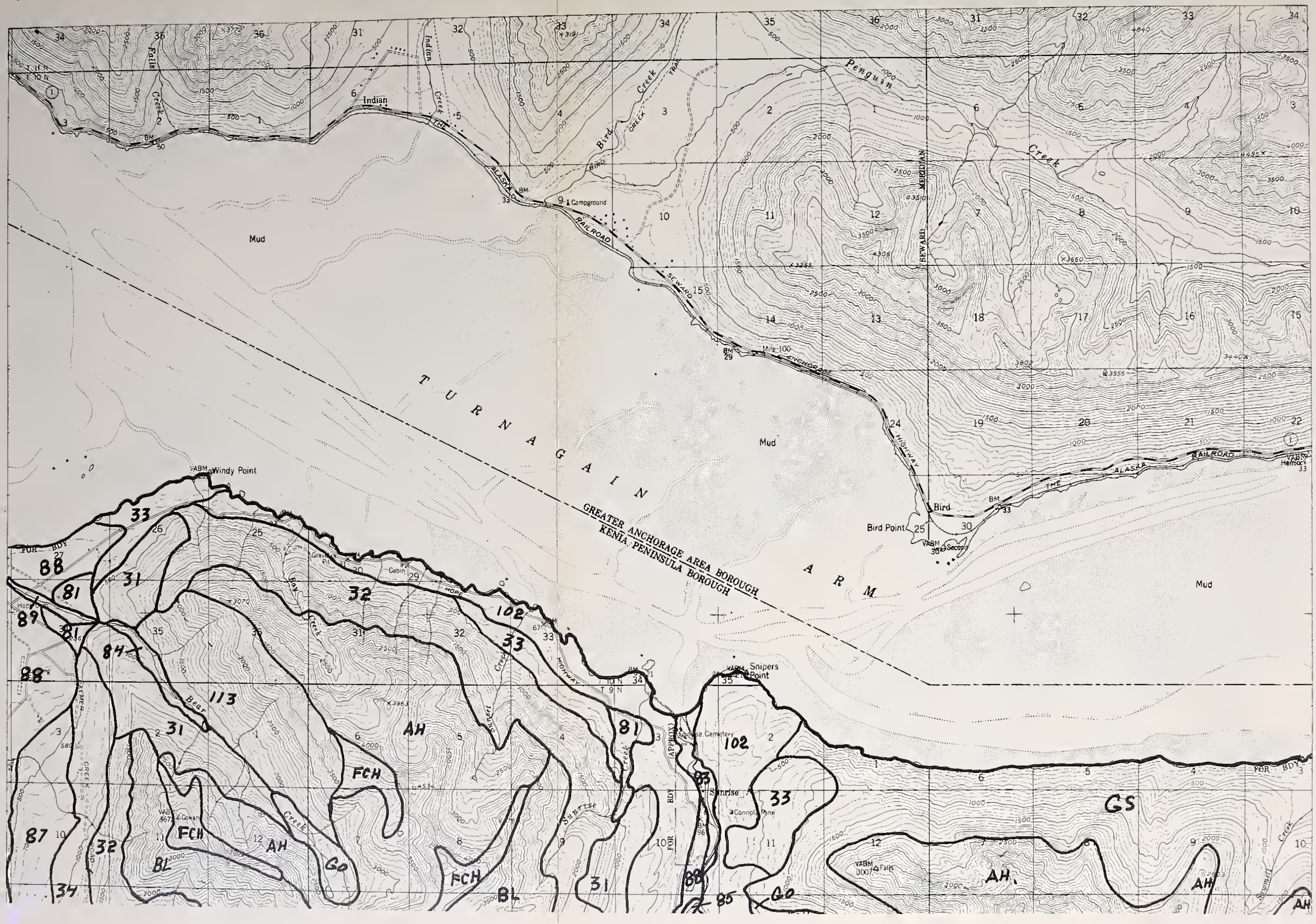

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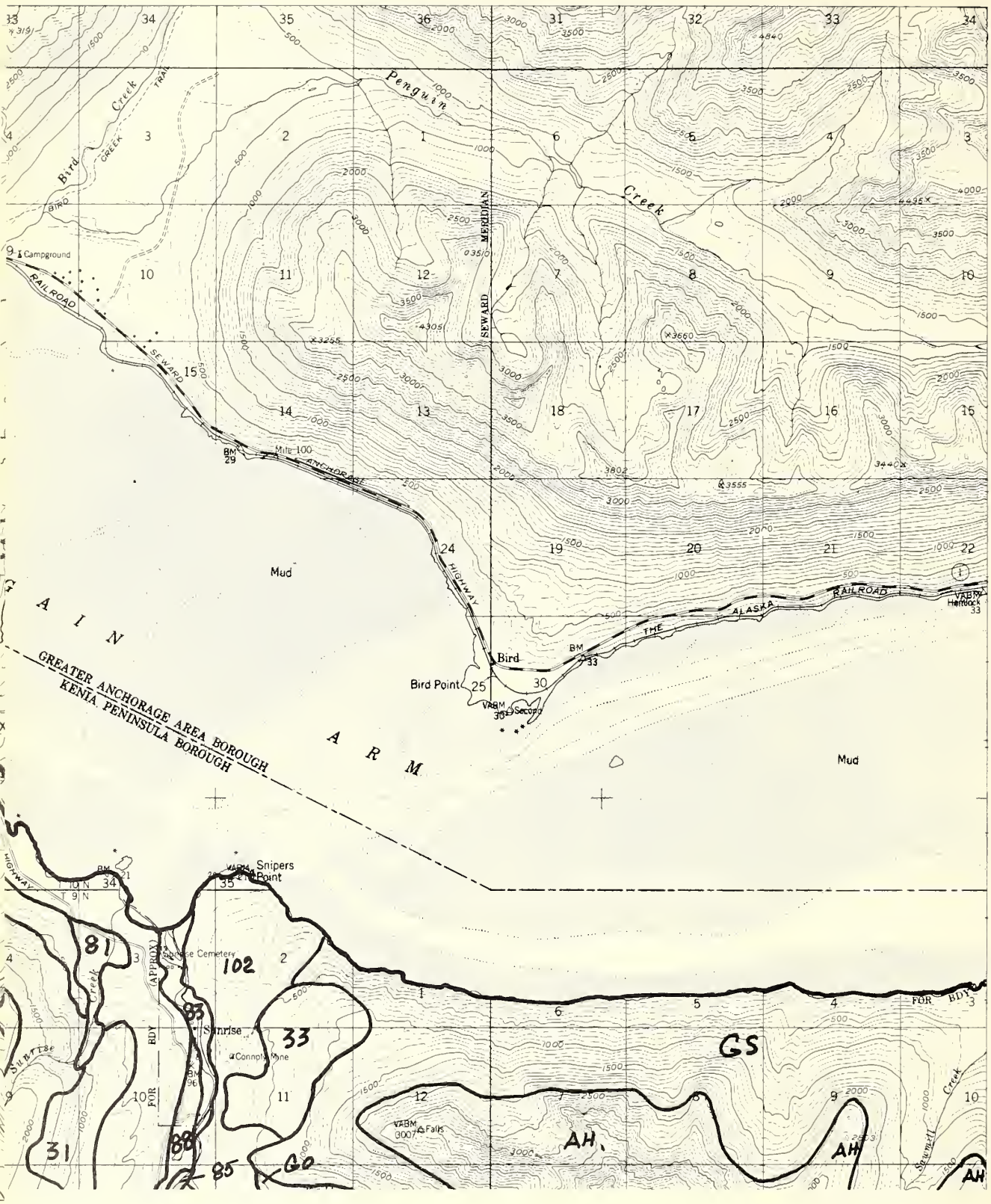
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TRAIL
Penguin Creek
SEWARD MERIDIAN
Campground
RAILROAD
SEWARD
Mile 100 ANCHORAGE
HIGHWAY
Mud
Bird
Bird Point
ALASKA RAILROAD
THE
VABM Hemlock
GREATER ANCHORAGE AREA BOROUGH
KENAI PENINSULA BOROUGH
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Cemetery
Sunrise
Connors Mine
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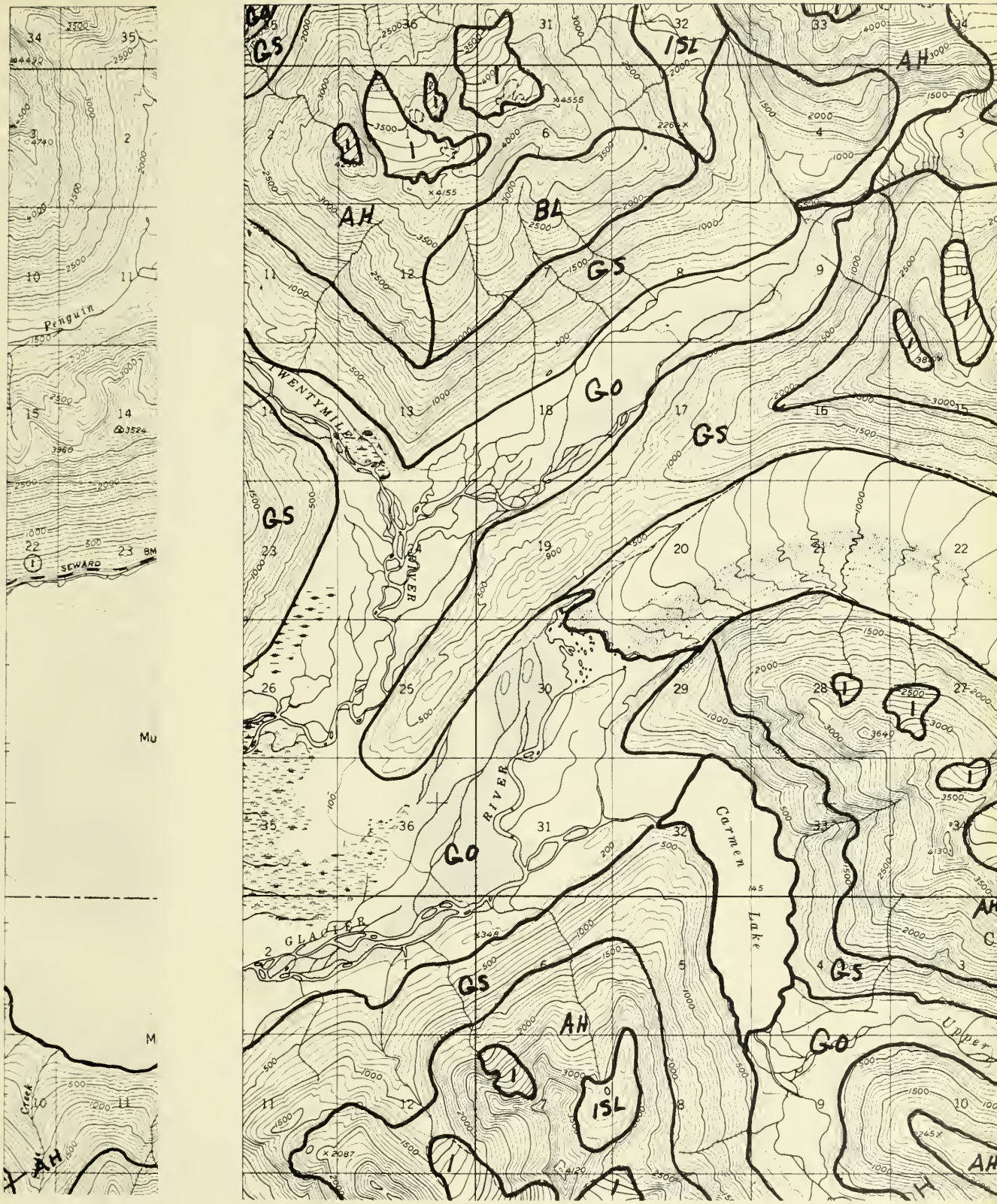

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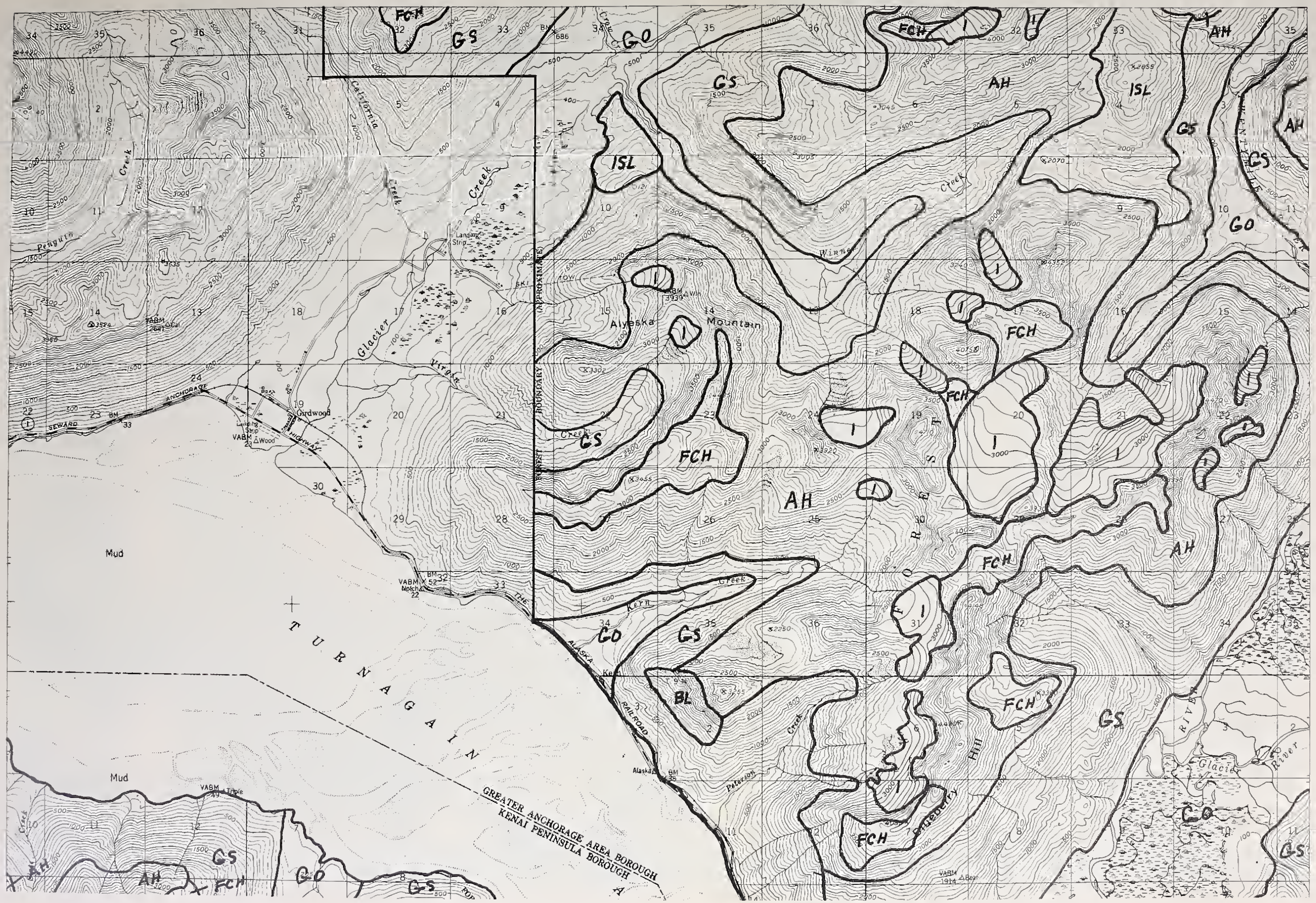

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Pigot Glacier
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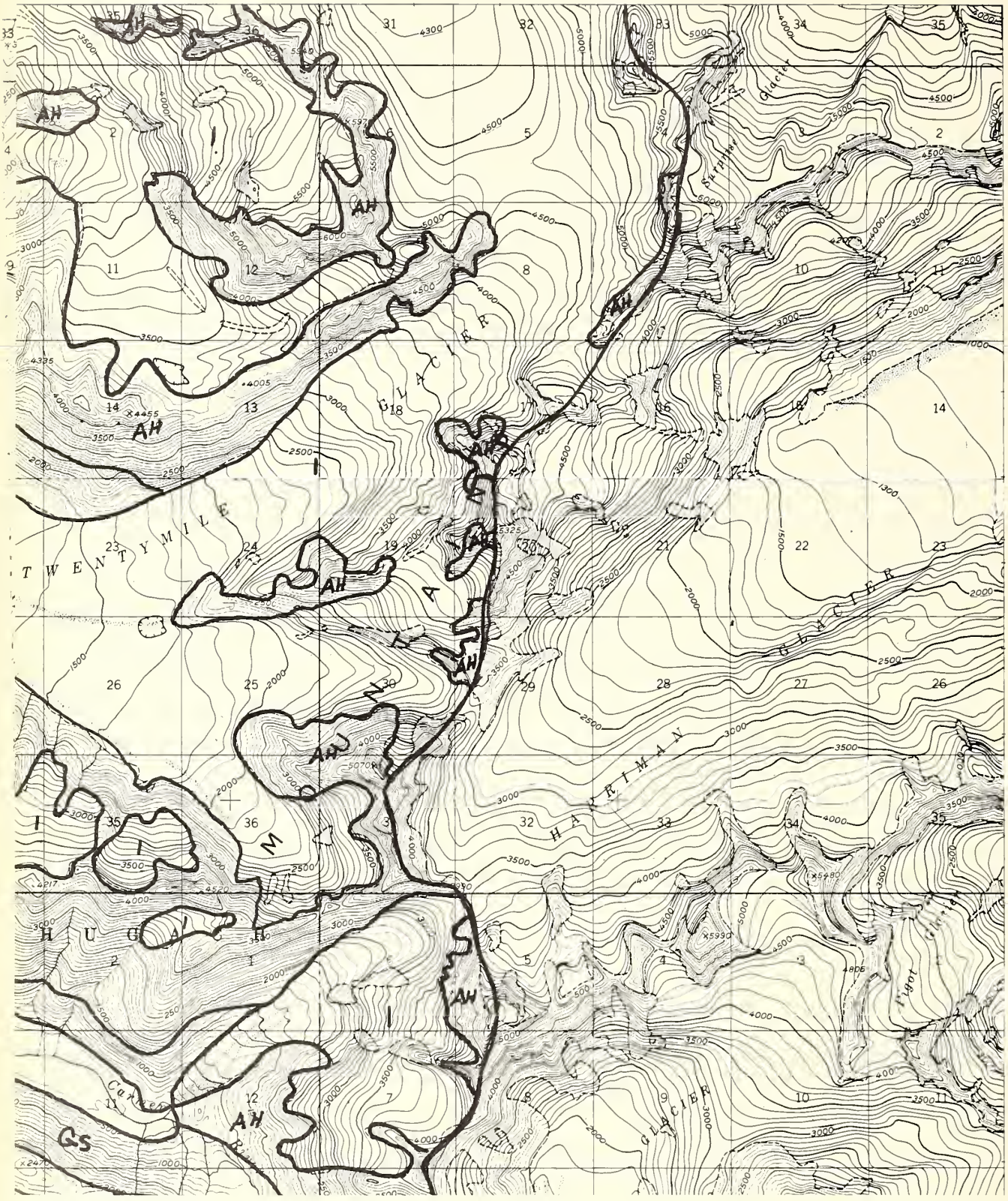
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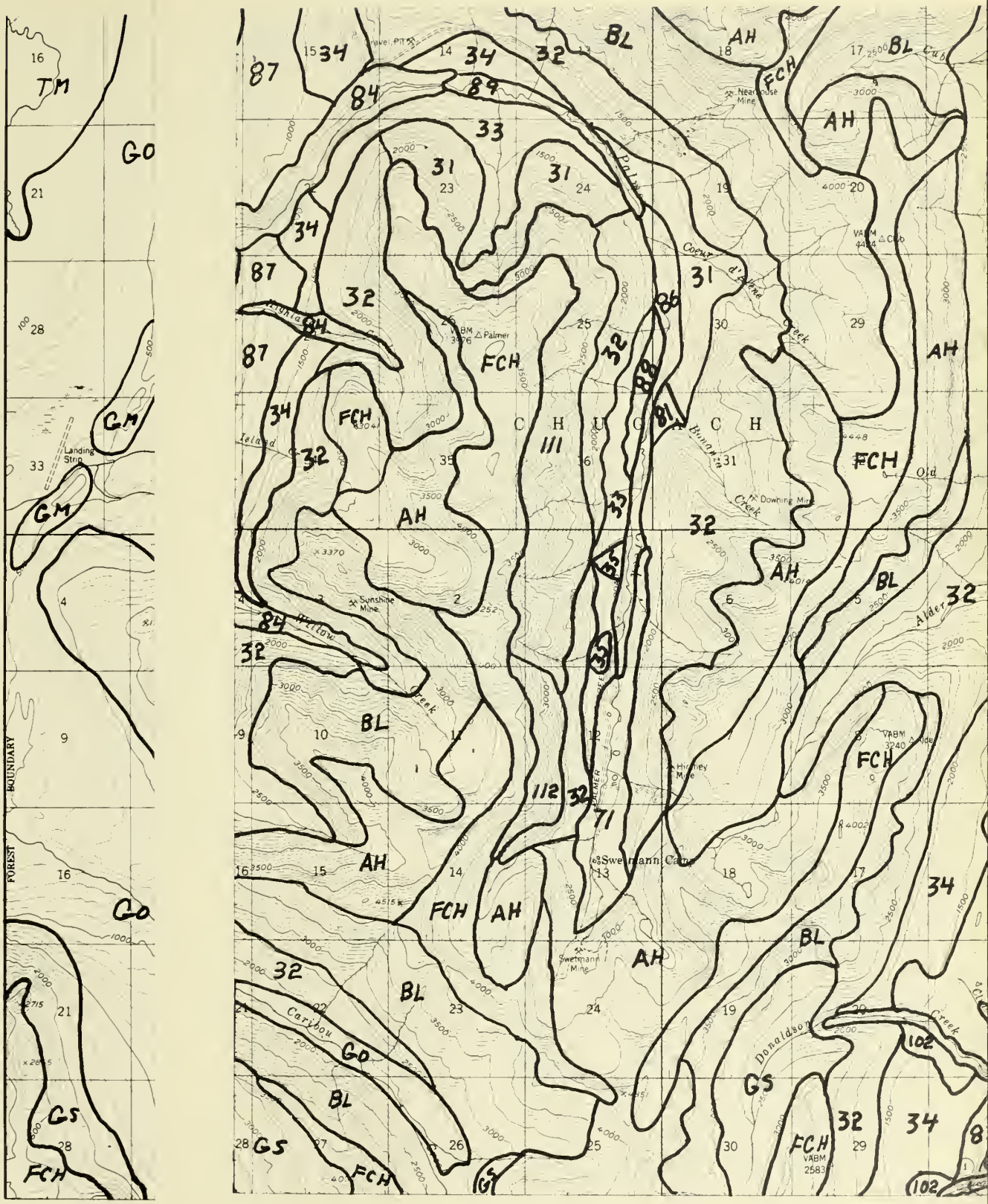
GLACIER
TWENTYMILE
HARRIMAN
GLACIER
HUGH
Canyon
GS
AH



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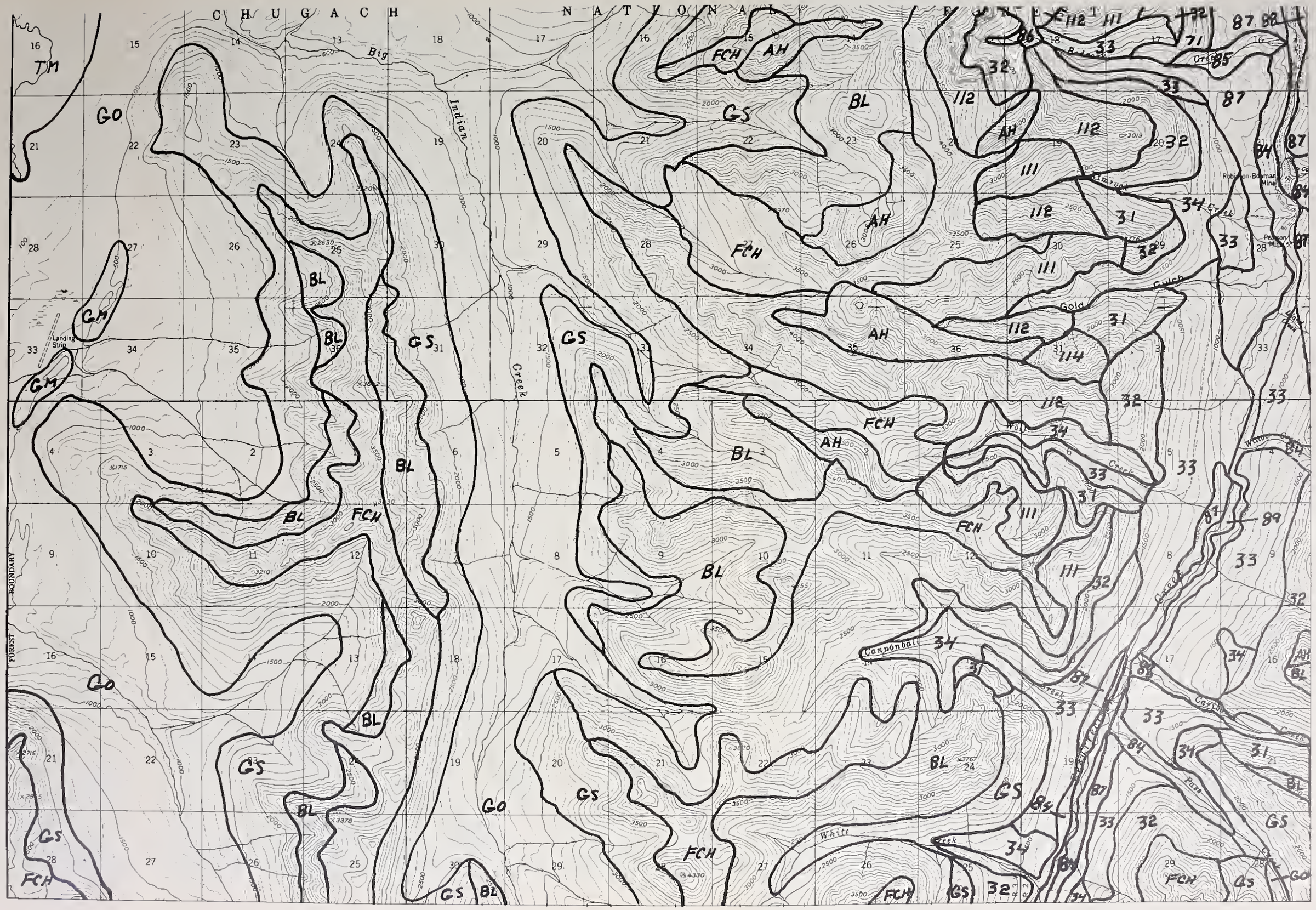

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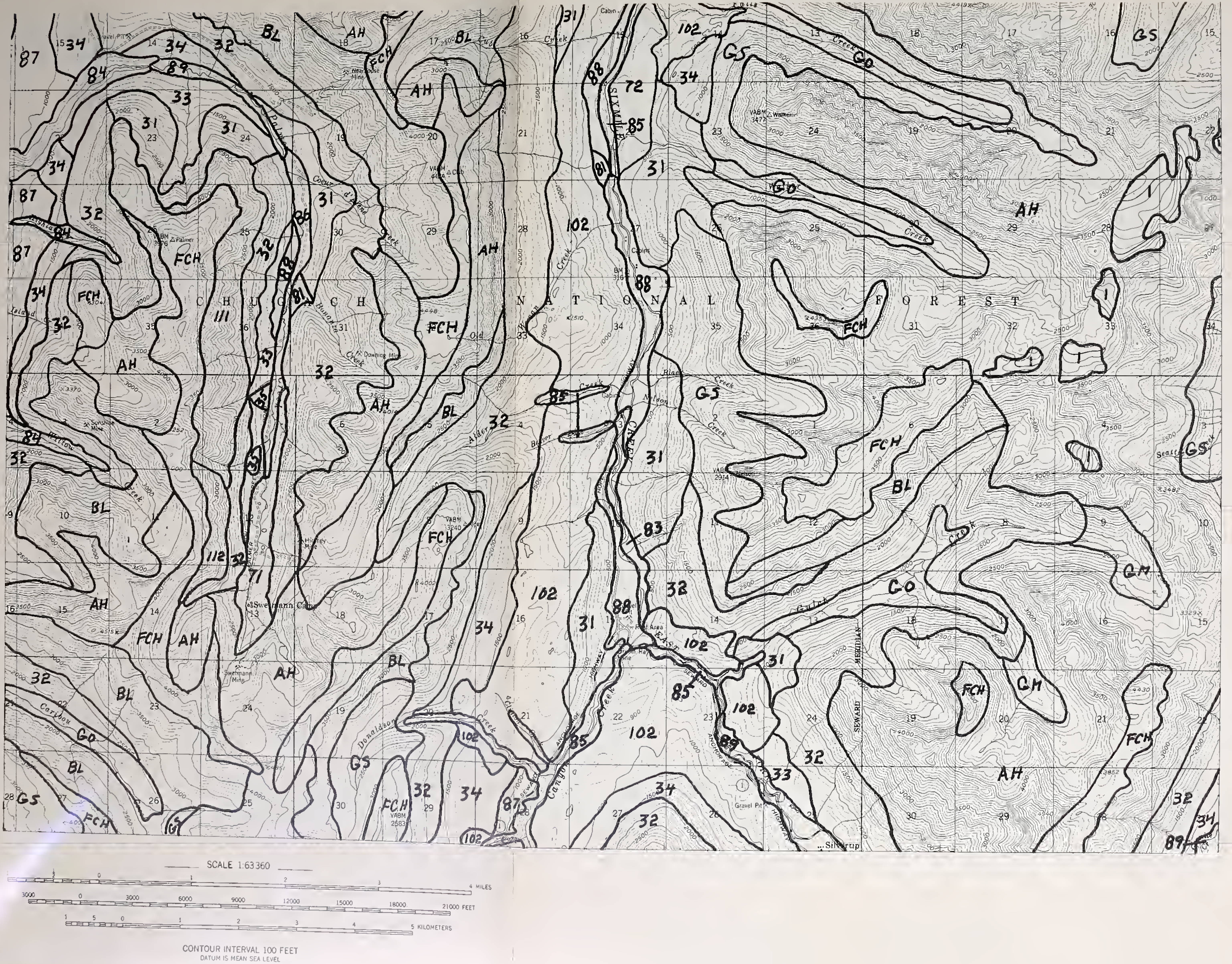
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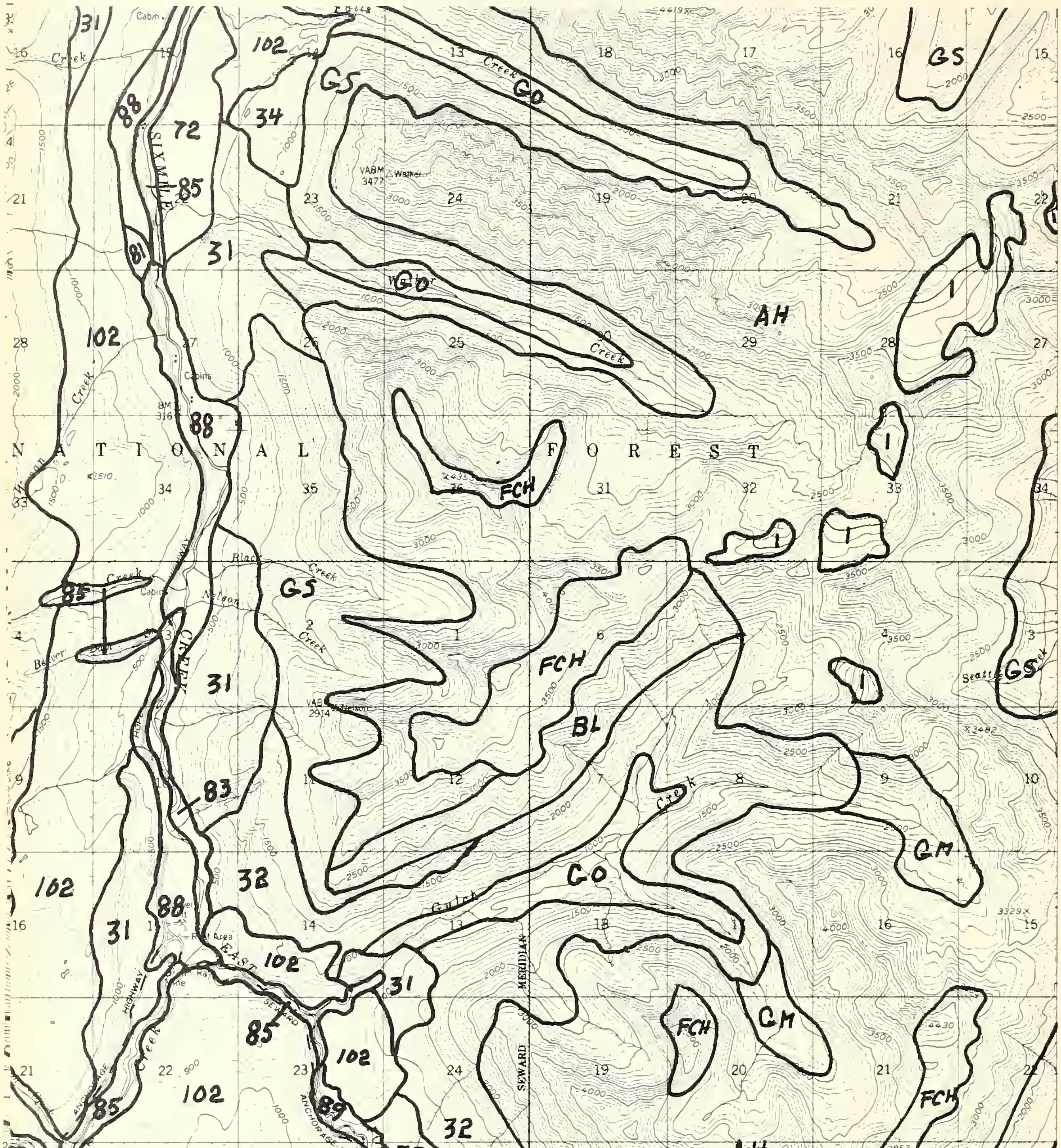
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Rest Area
Gravel Pit
Silvertip
VABM Walker 3477
VABM Nelson 2914
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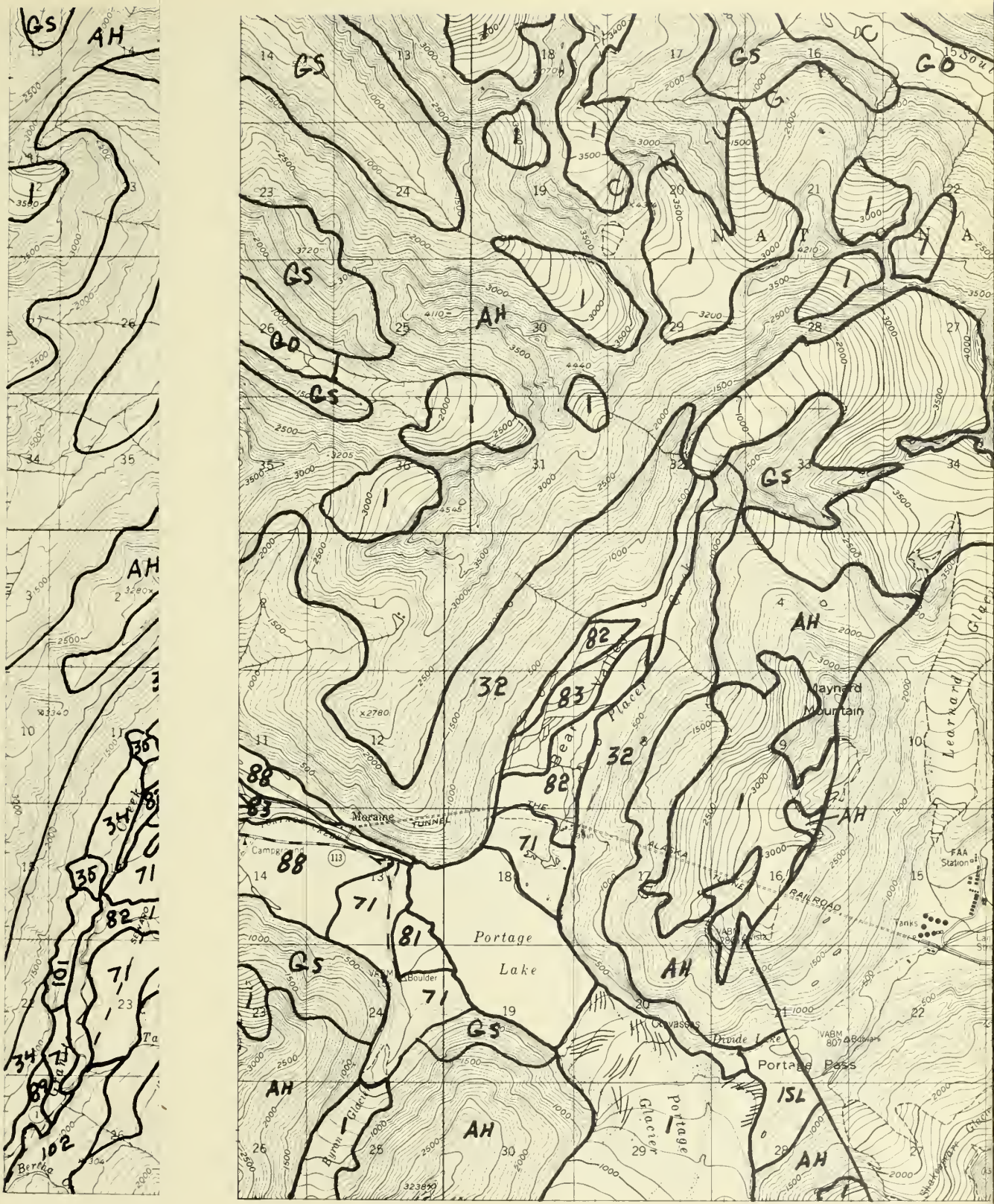

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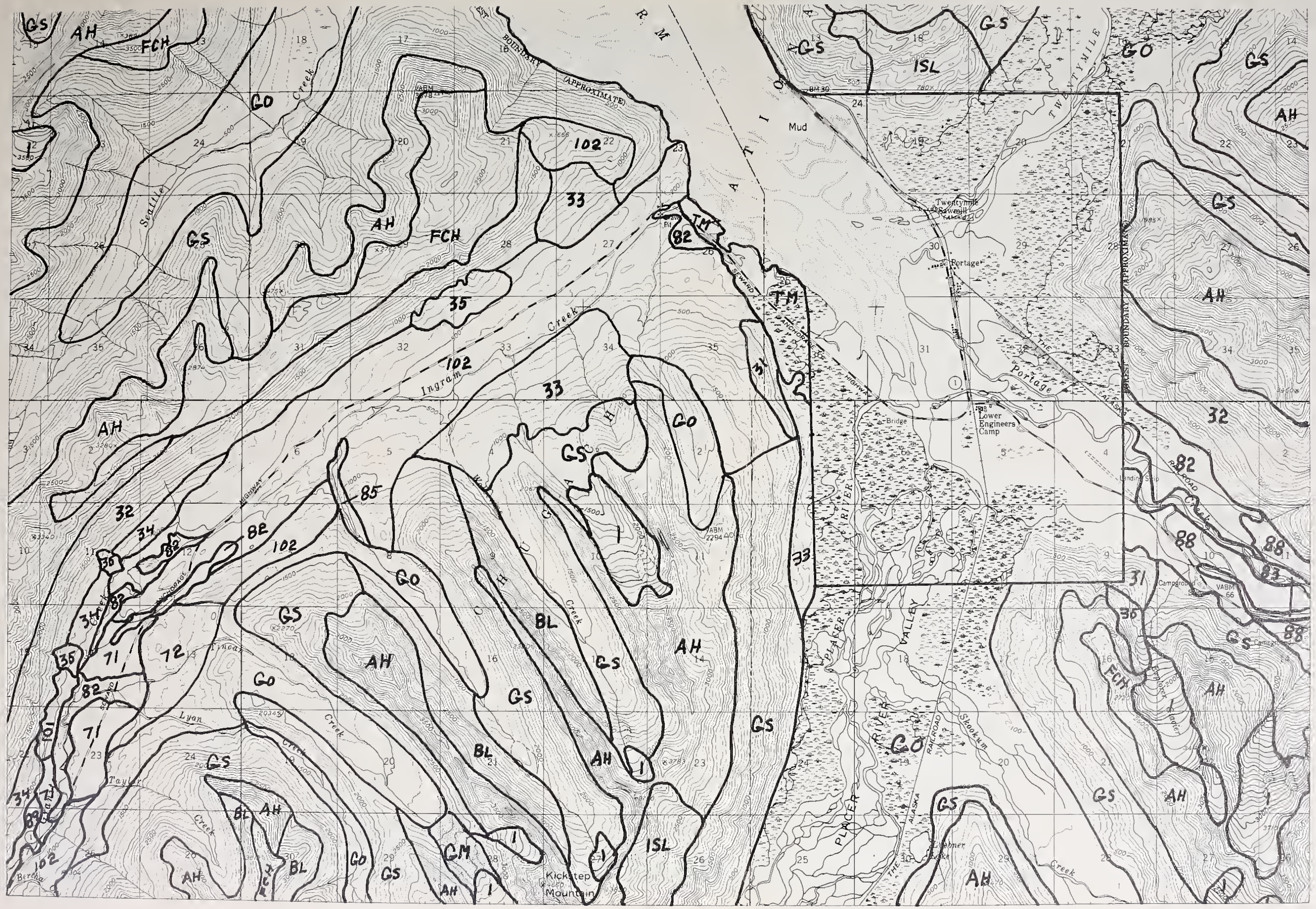

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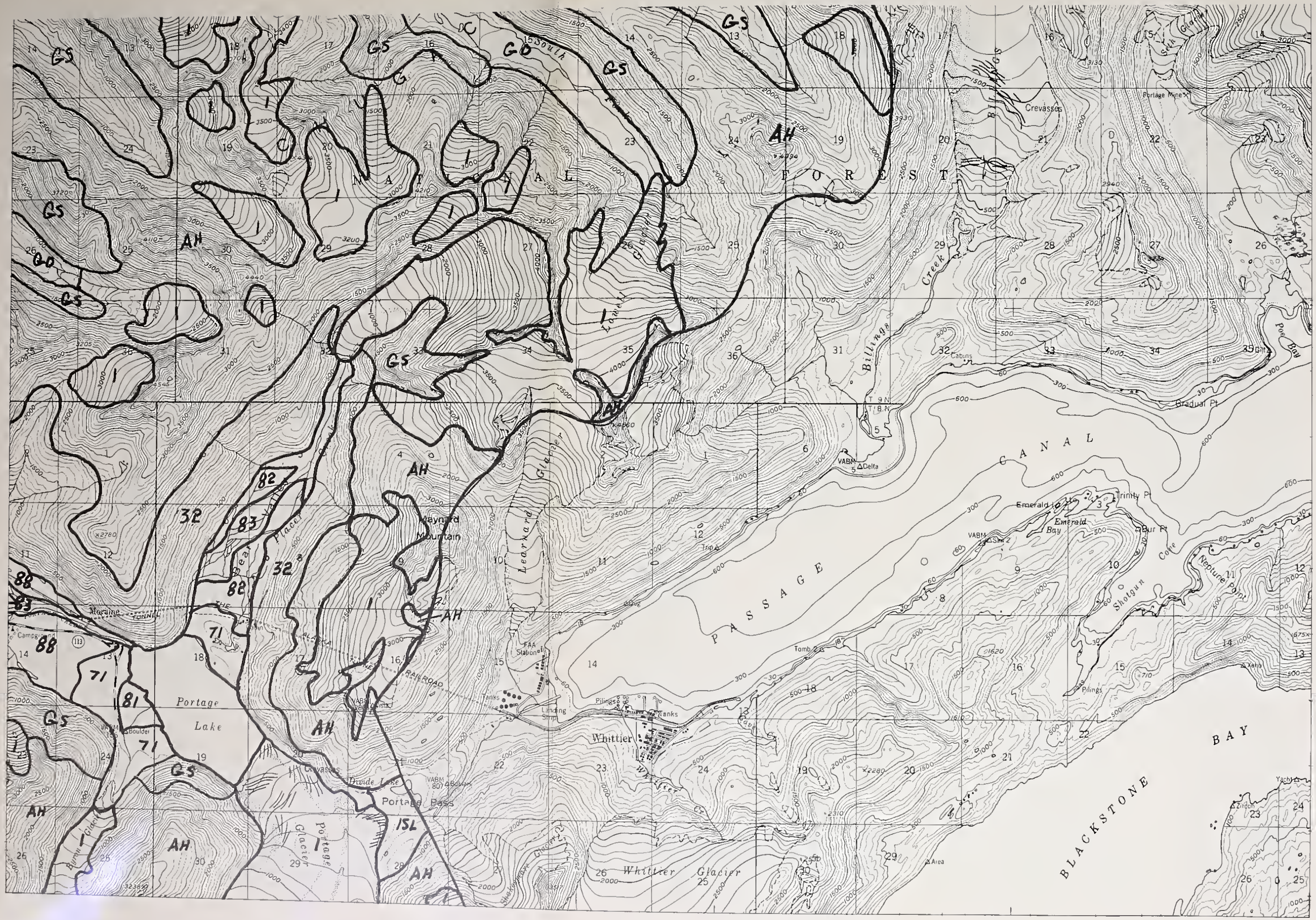
3000 0 3000 6000 9000 12000 15000 18000. 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL



SCALE 1:63360

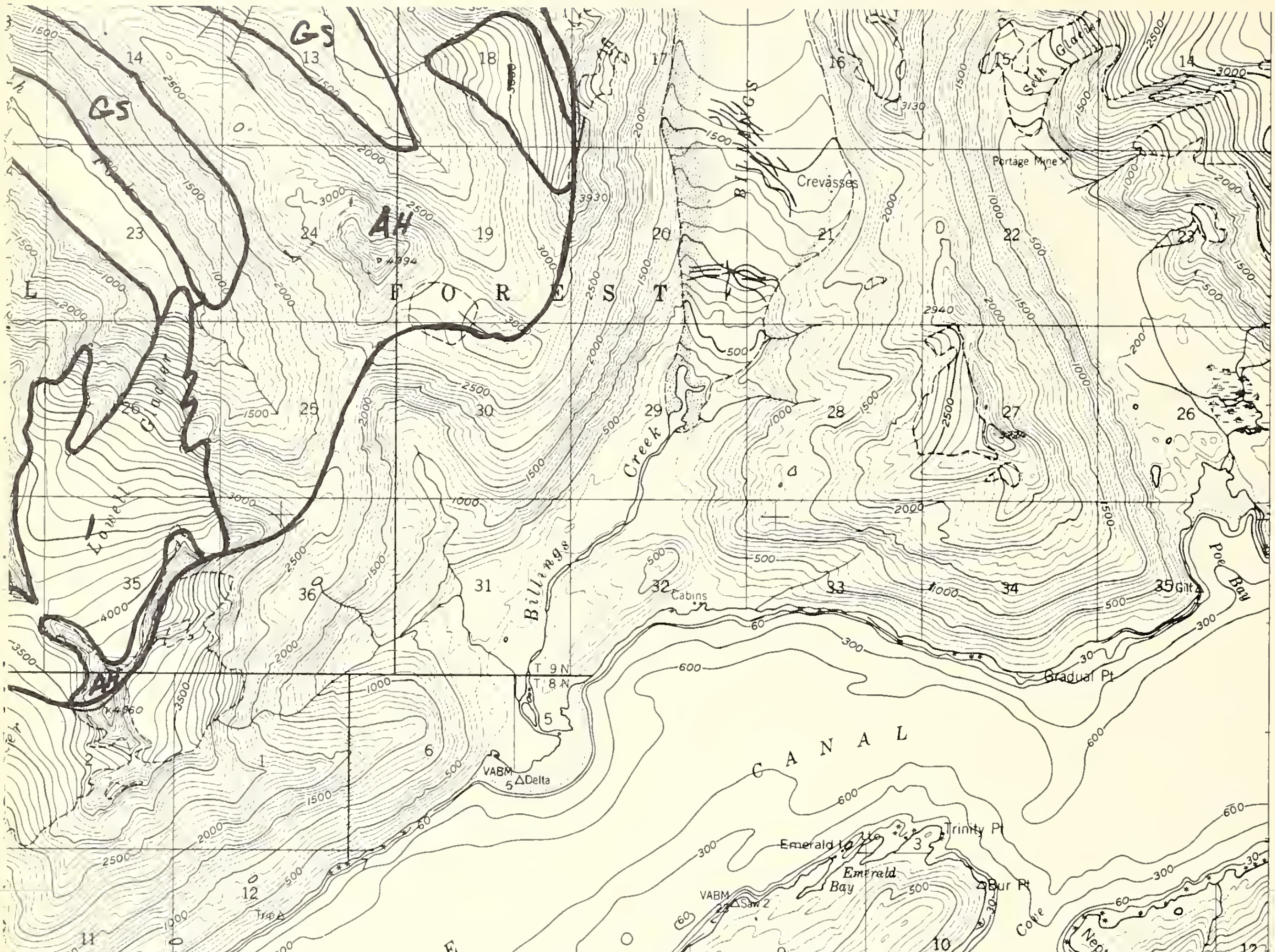
4 MILES

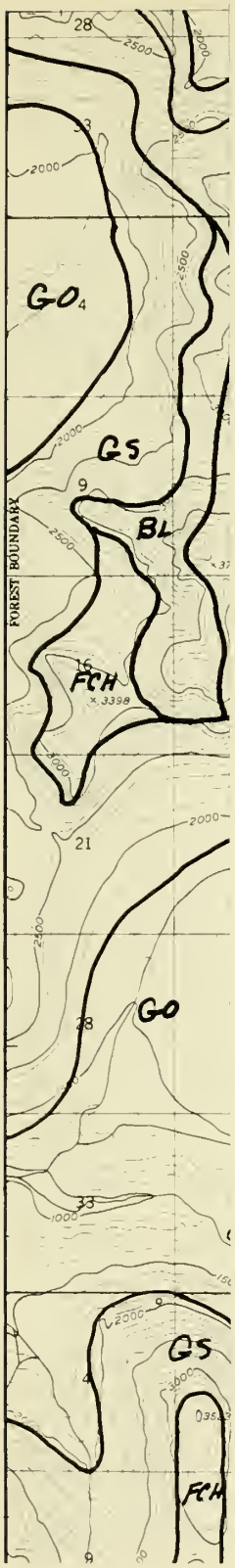
21000 FEET

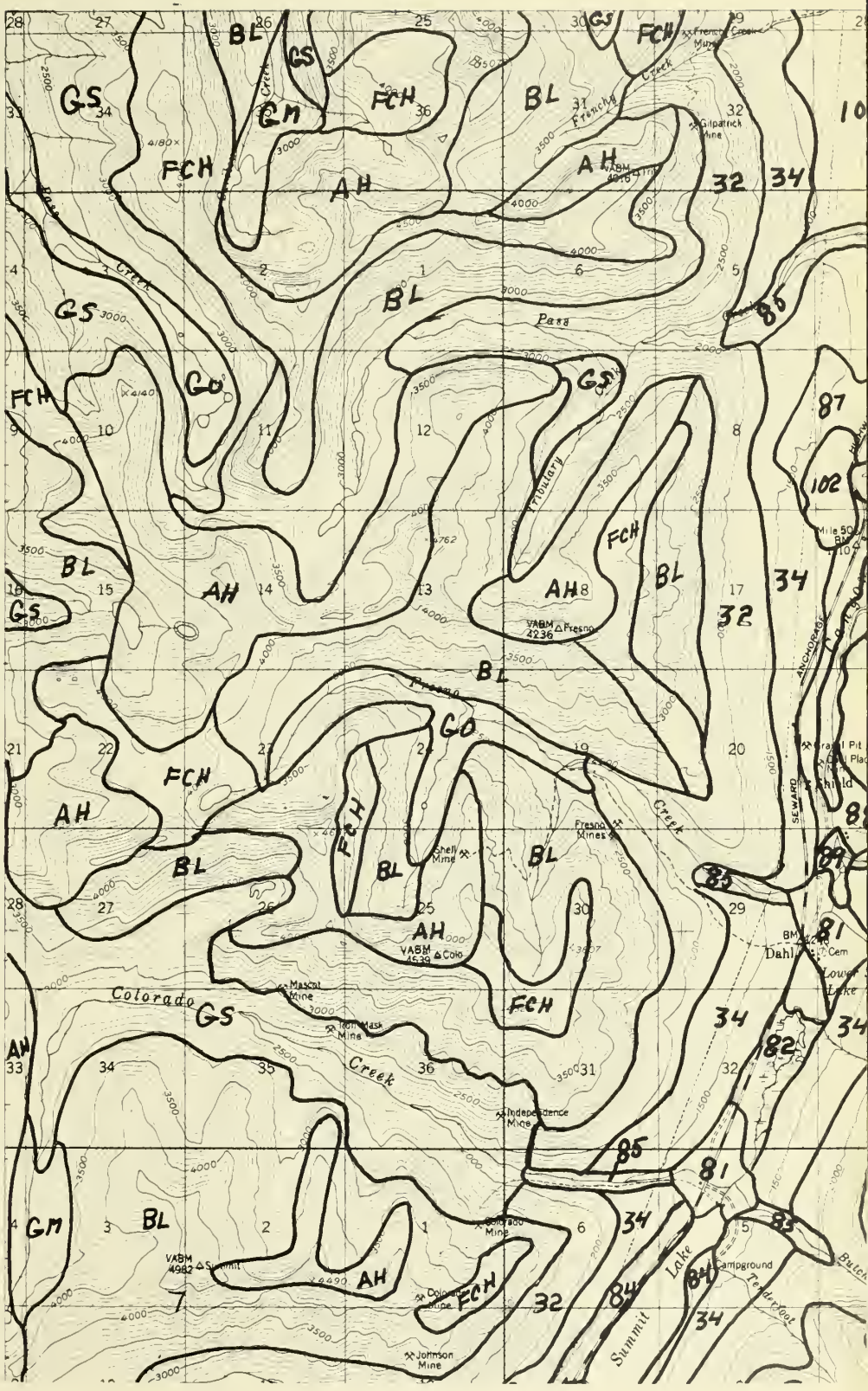
5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


GS
AH
F O R E S T
L
Lowell Glacier
Billings Glacier
Seth Glacier
Portage Mine
Crevasses
Billings Creek
Cabins
Gilt
Poe Bay
Gradual Pt
T 9 N
T 8 N
VABM
Delta
C A N A L
P A S S A G E
Emerald Is
Emerald Bay
Trinity Pt
Bur Pt
Saw 2
Trip
Shotgun Cove
Neptune Point
Tomb 2
Pilings
Tanks
Whittier
Whittier Cr
Cove Cr
Whittier Glacier
Xeno
Yacht
Zircon
Area
BLACKSTONE BAY





SCALE 1 63360

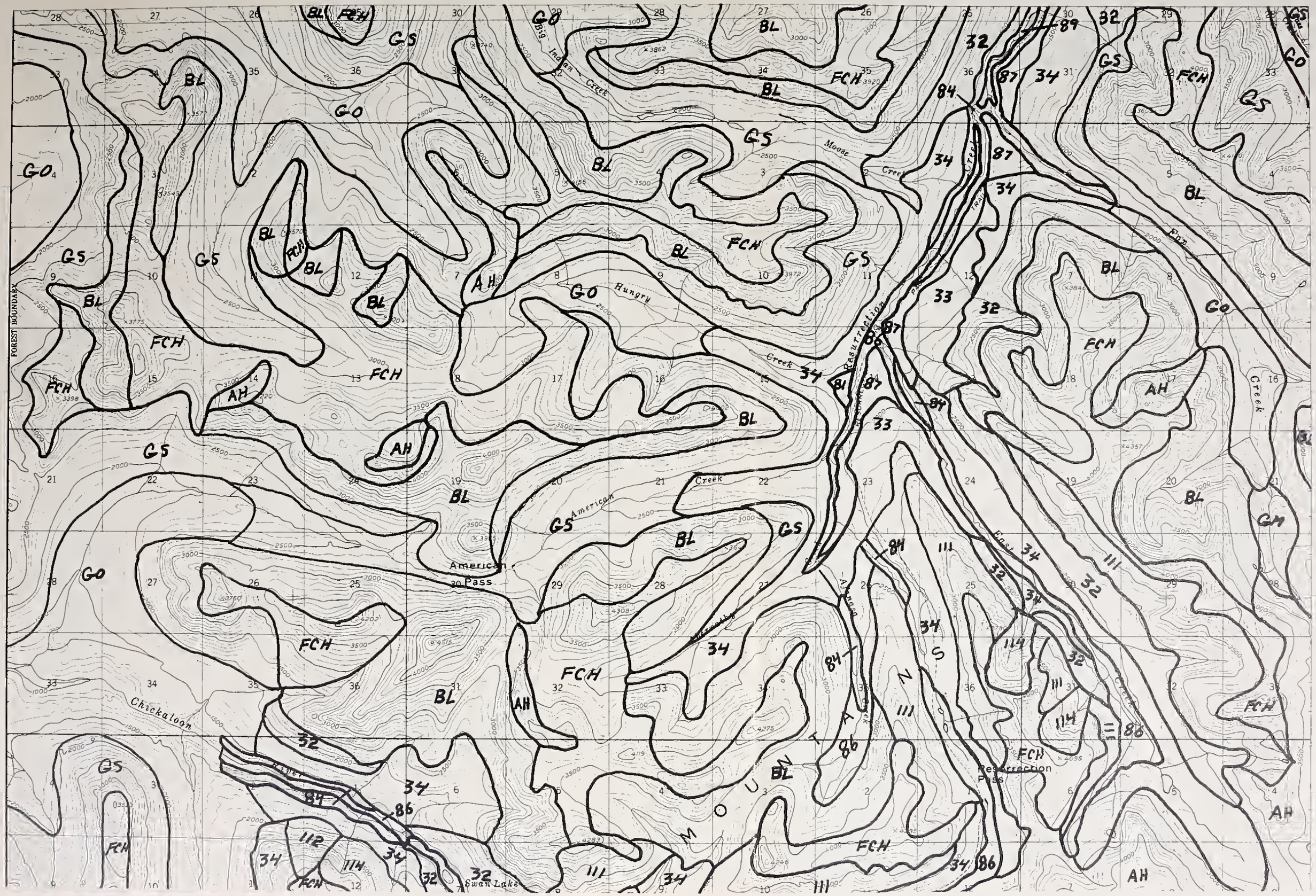
4 MILES

21000 FEET

5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



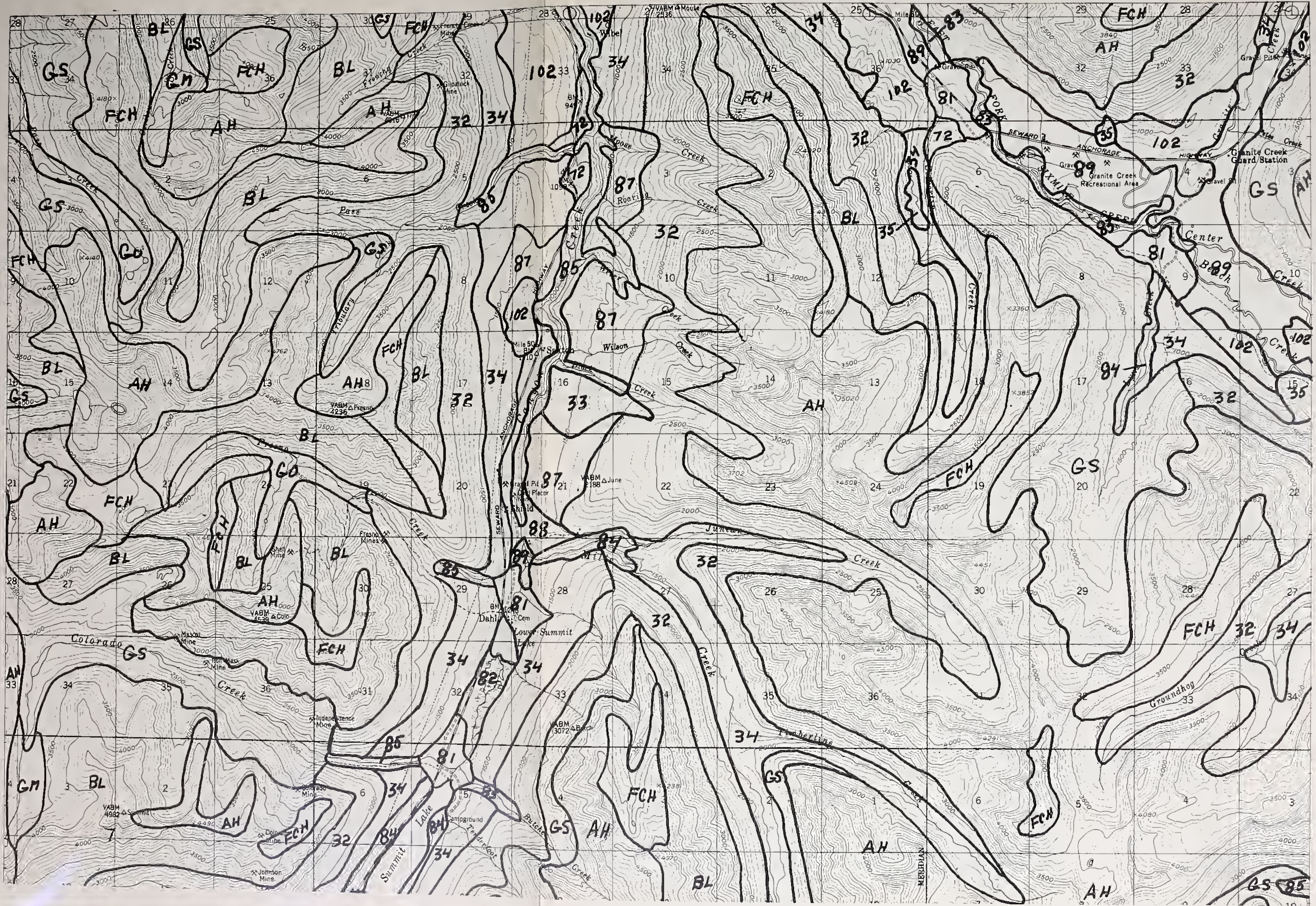
SCALE 1:63360

1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000. 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL



SCALE 1:63360

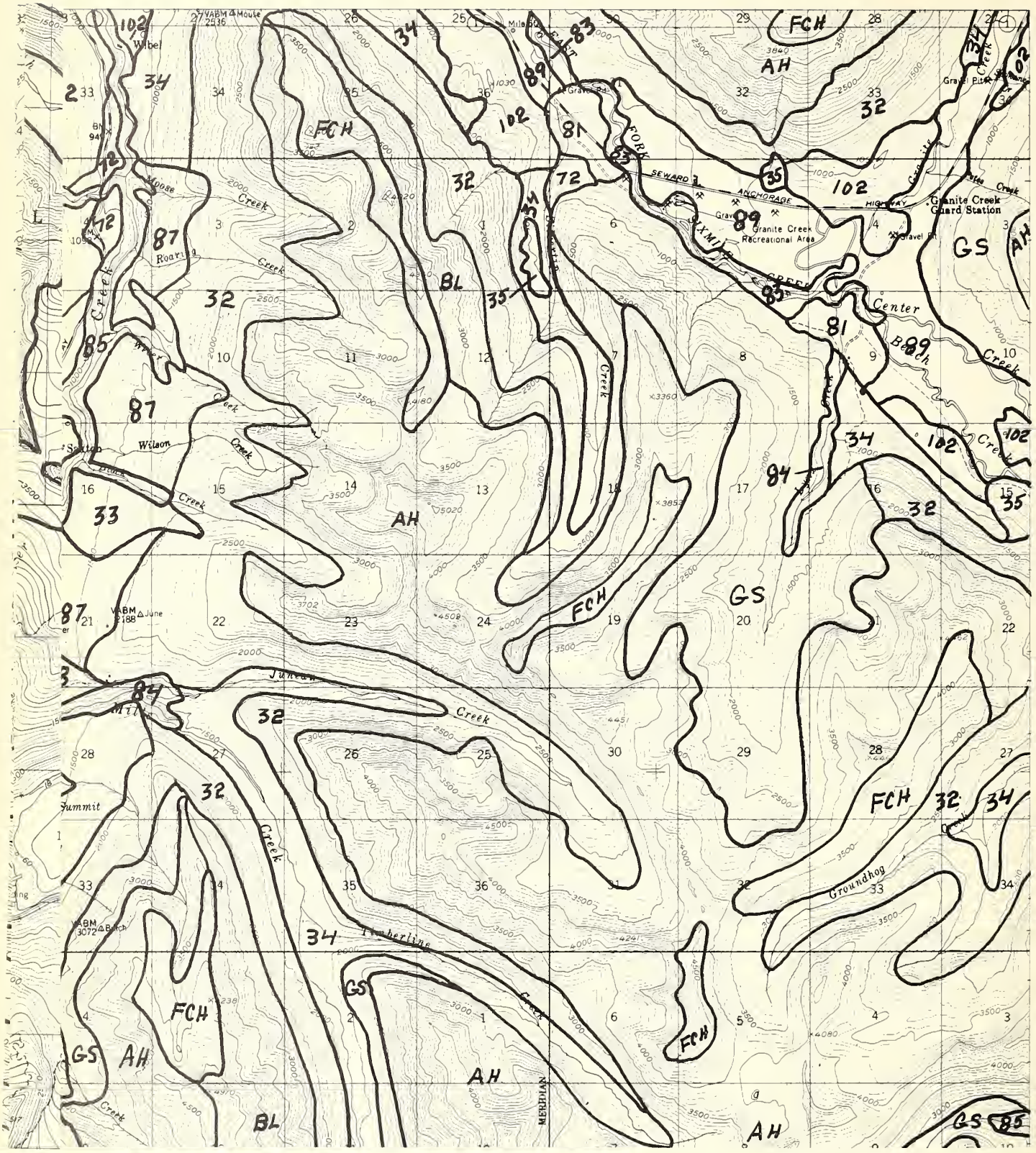
1 ½ 0 1 2 3 4 MILES

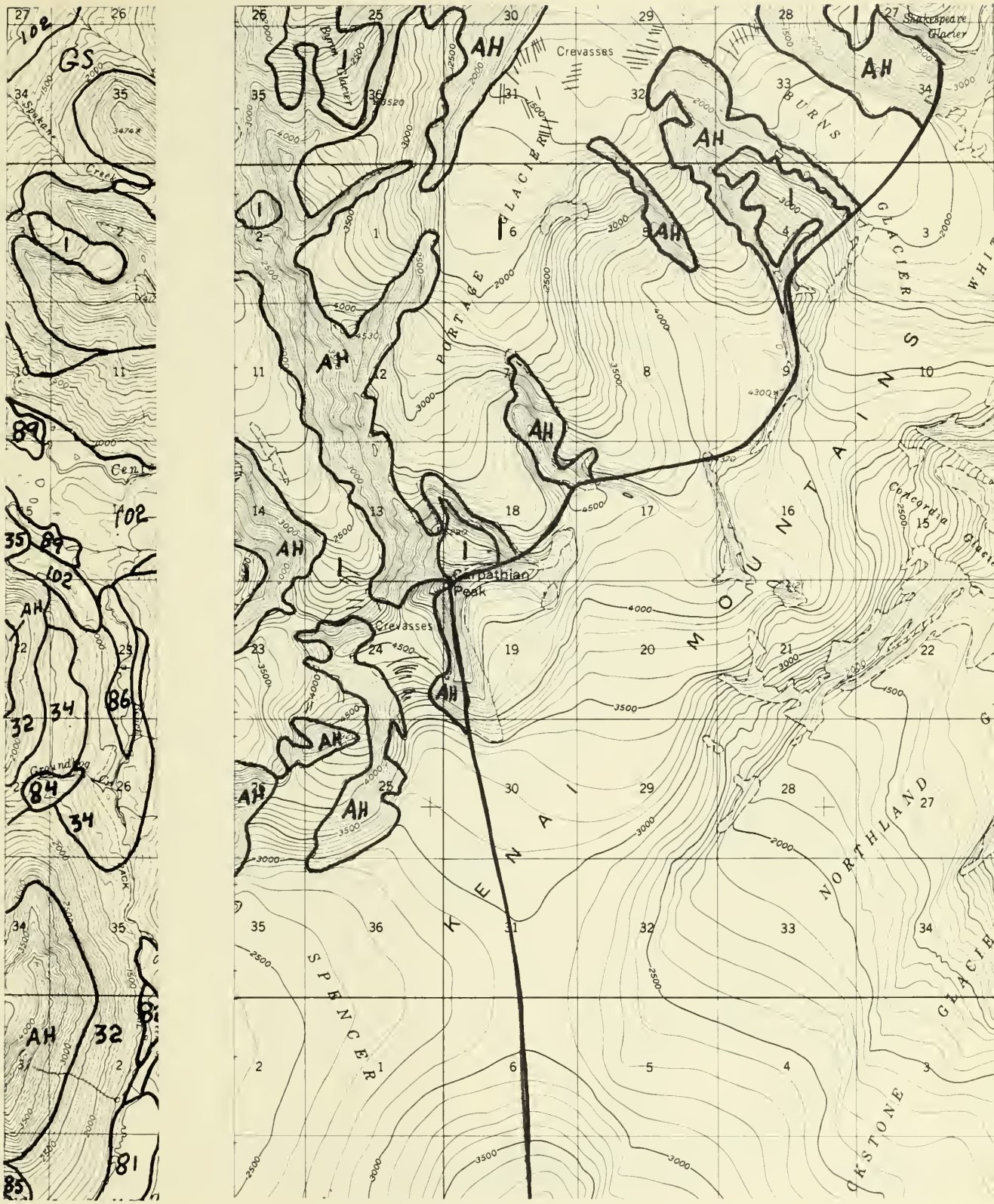
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


SEWARD
ANCHORAGE
HIGHWAY
Granite Creek
Recreational Area
Granite Creek
Guard Station
Moose
Creek
Roaring
Creek
Wilson
Creek
Salmon
Creek
Center
Creek
Junction
Creek
Summit
Timberline
Creek
Groundhog
Creek
MERIDIAN
AH
FCH
GS
BL



SCALE 1 63360

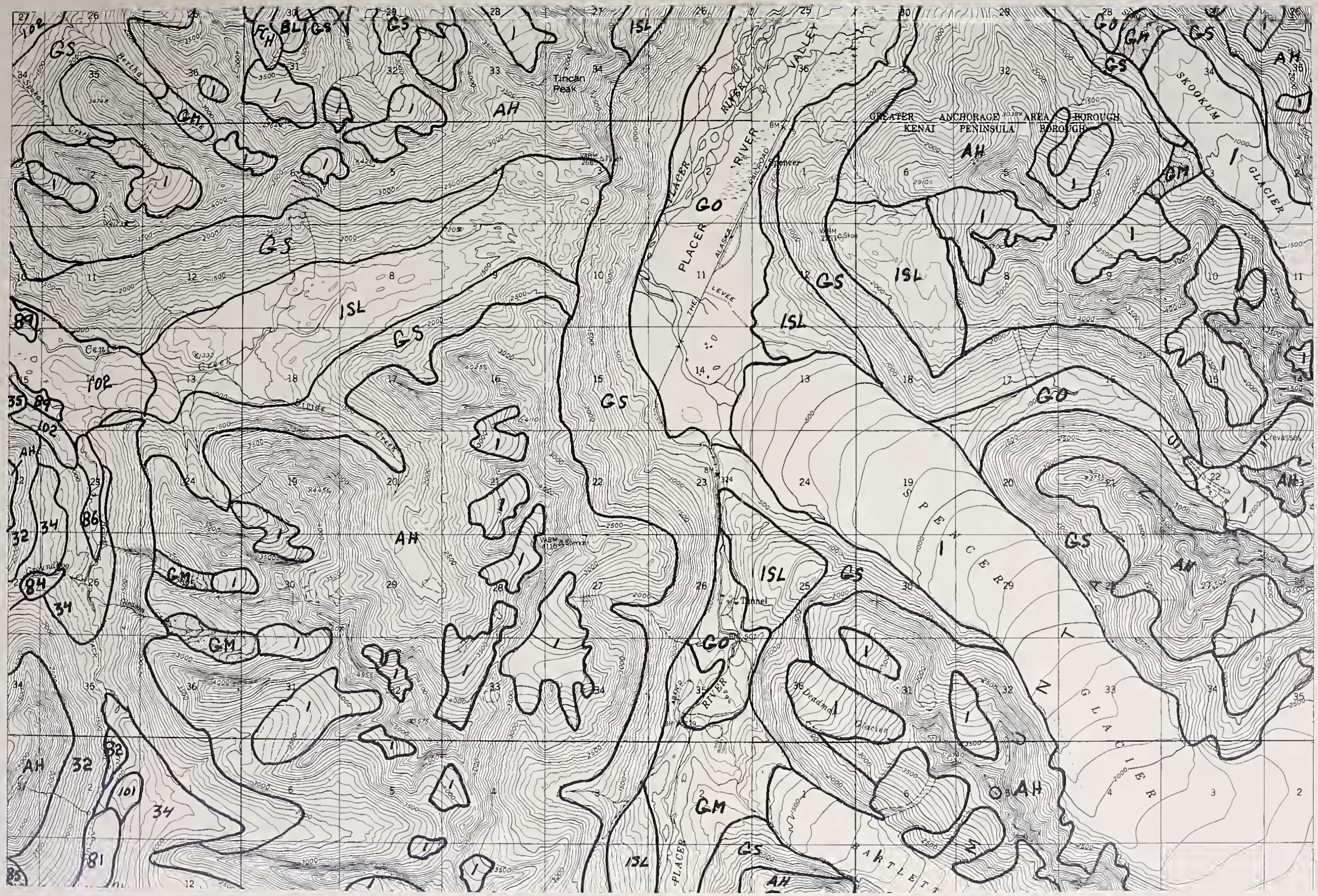
1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



SCALE 1:63360

1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

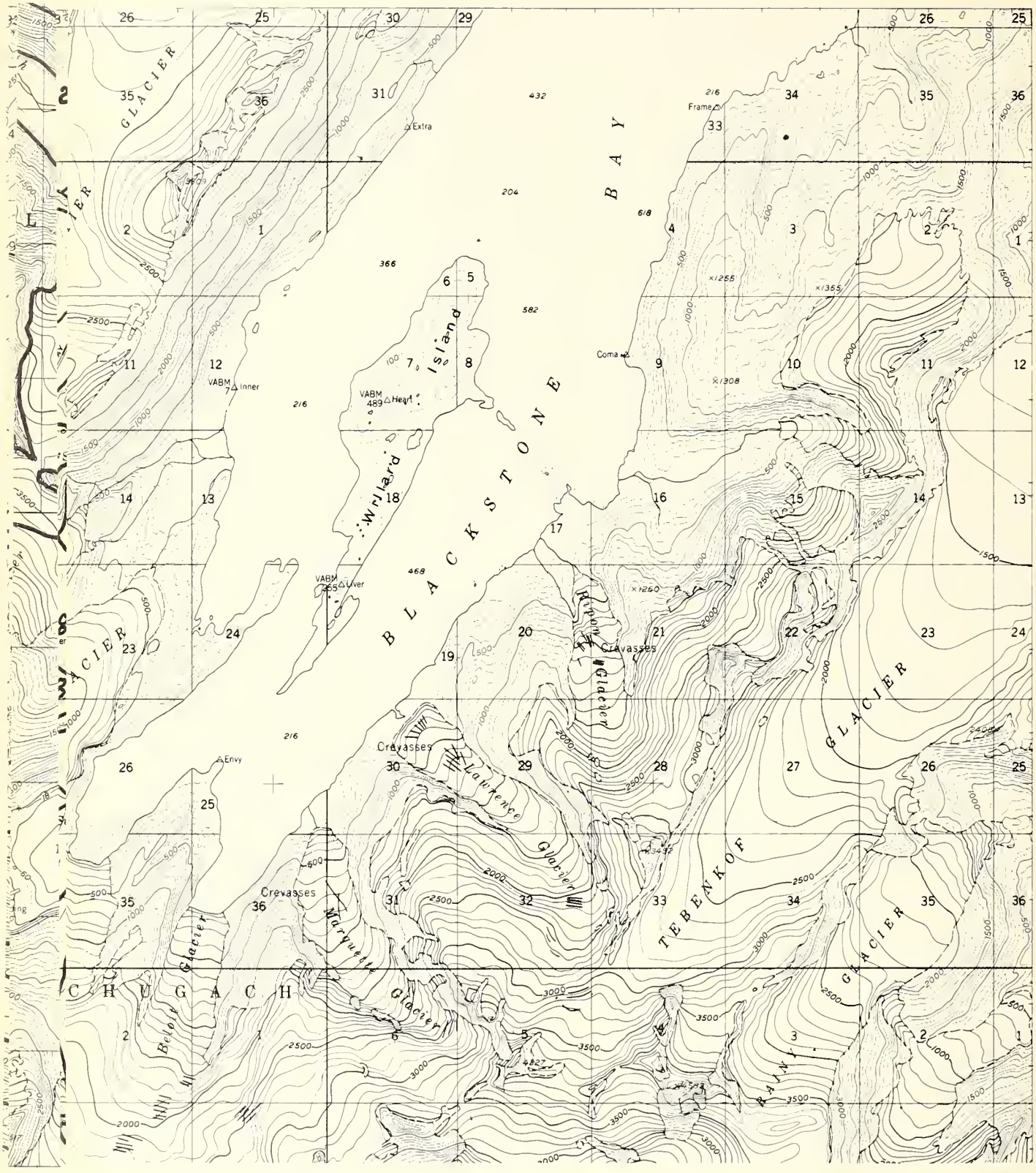
SCALE 1:63360

1 ½ 0 1 2 3 4 MILES

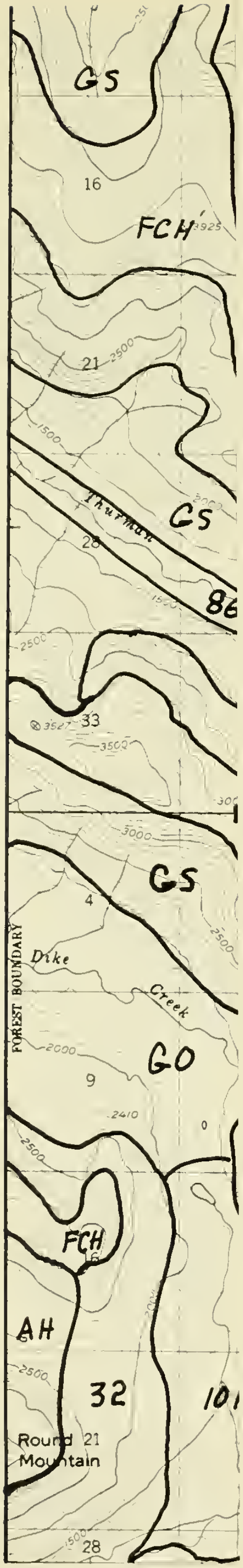
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

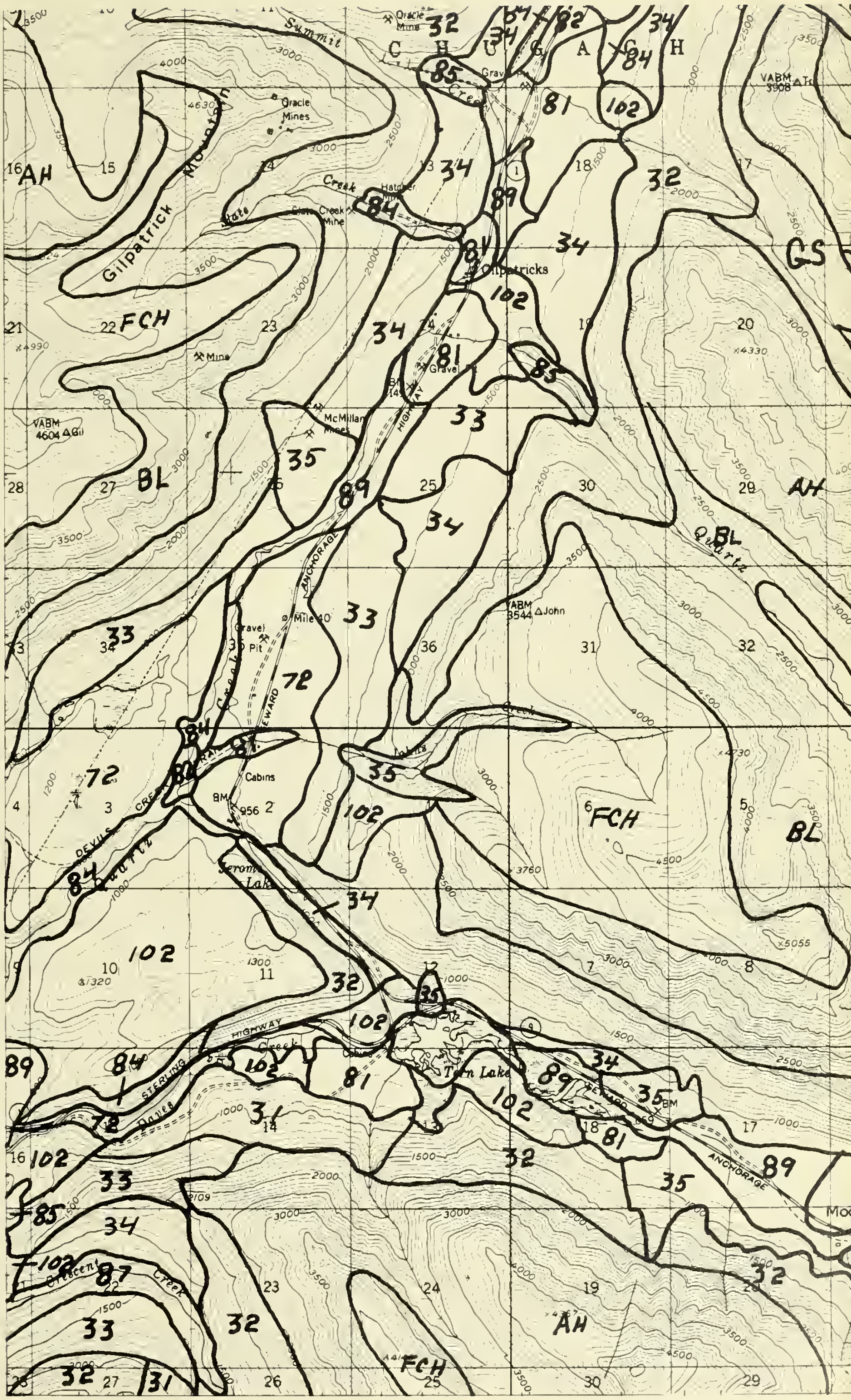
1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

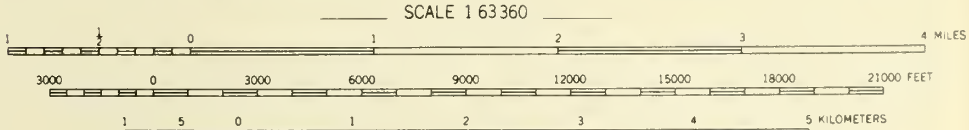

BLACKSTONE BAY
Willard Island
TEBENKOF GLACIER
RAINY GLACIER
CHUGACH
Marquette Glacier
Lawrence Glacier
Ruppert Glacier
Crevasses
Extra
Frame
Coma
Heart
Inner
Envy
Liver
Below Glacier
GLACIER

Map Sheet 16





SCALE 1 63360

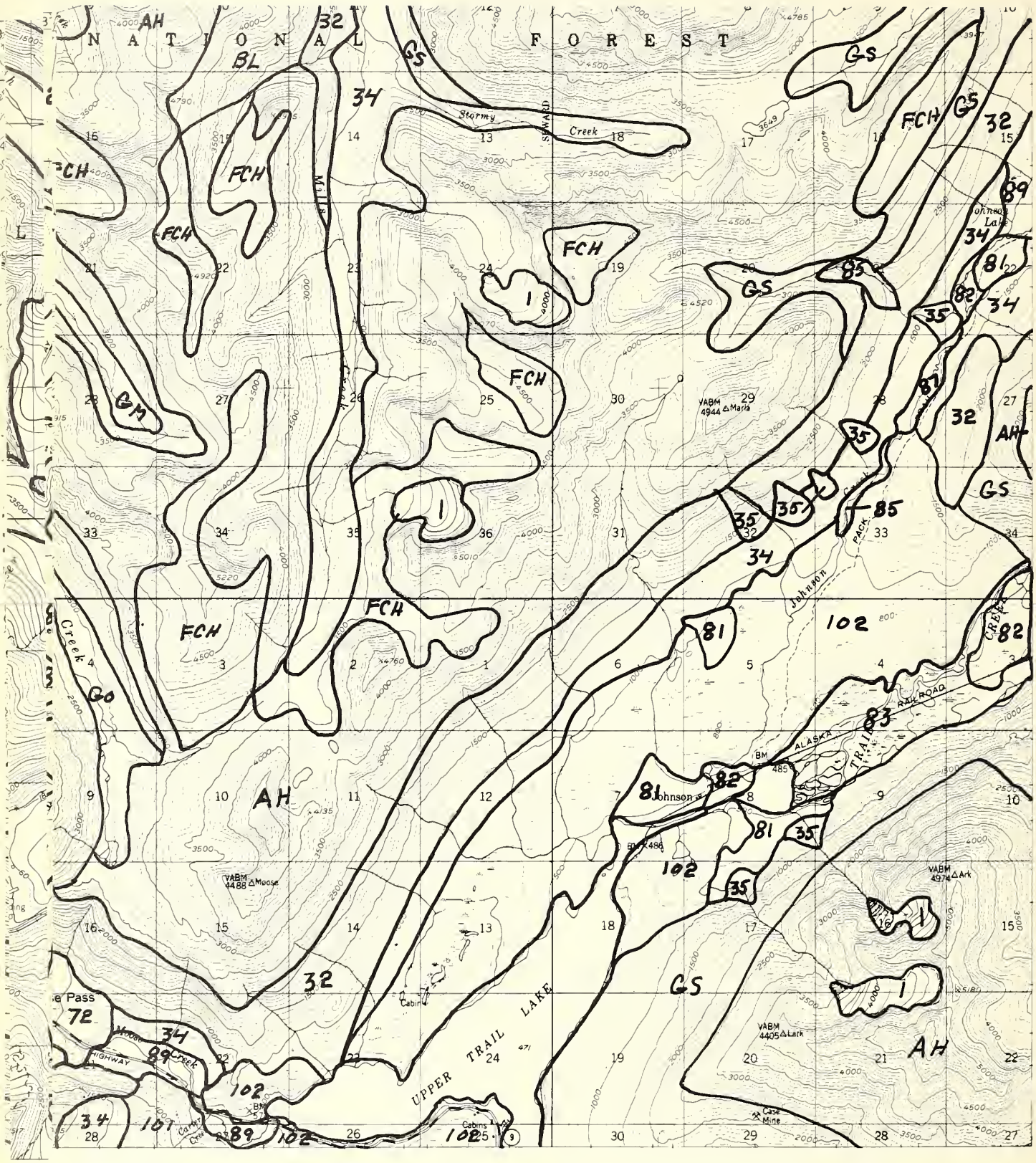


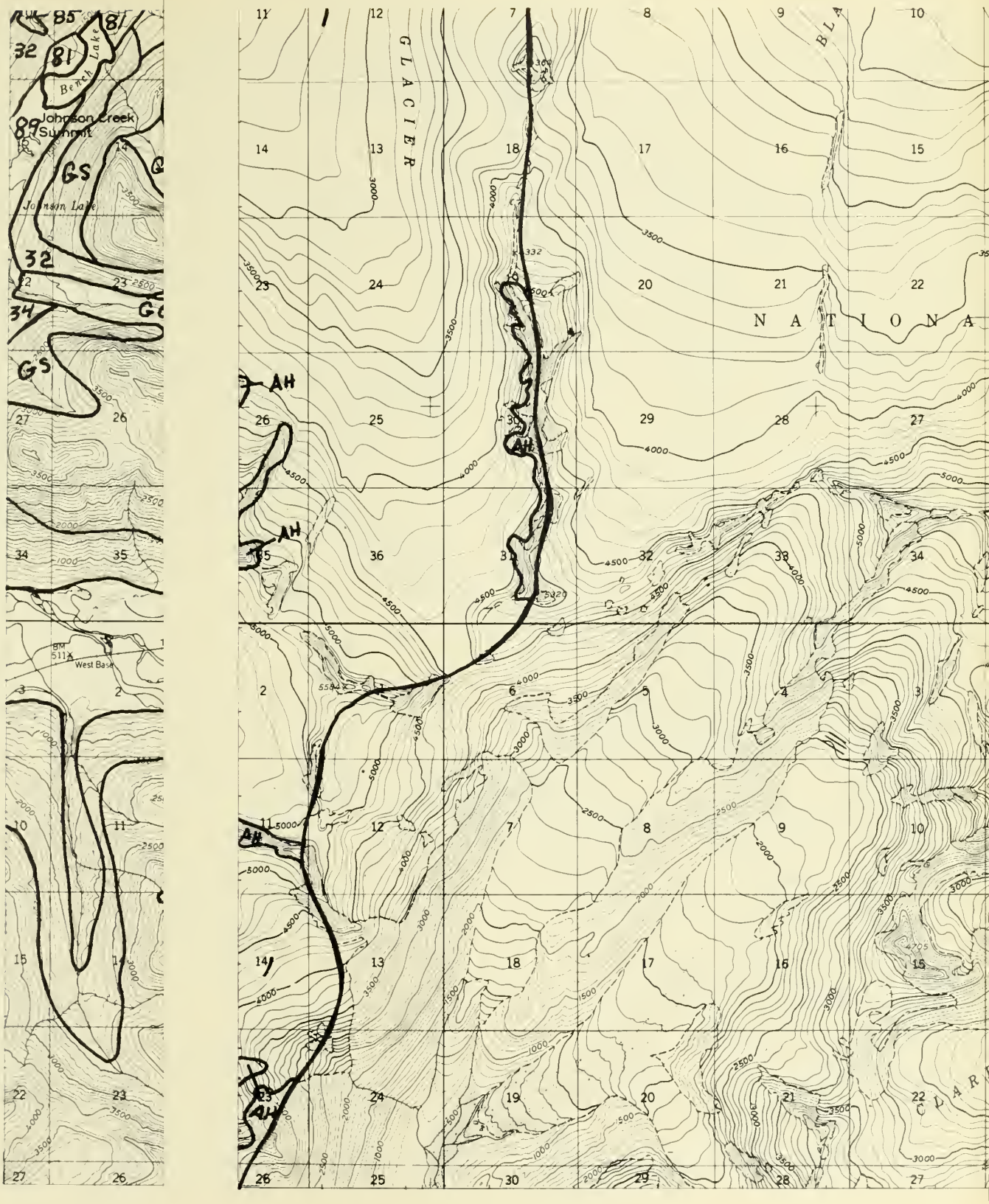
CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL

Fold-out Placeholder

This fold-out is being digitized, and will be inserted at a future date.


NATIONAL FOREST
Stormy Creek
SEWARD
Johnson Lake
Johnson Creek
ALASKA RAILROAD
TRAIL
Johnson
UPPER TRAIL LAKE
Cabins
Cabin
Case Mine
HIGHWAY
VABM 4944 △Maria
VABM 4488 △Moose
VABM 4974 △Ark
VABM 4405 △Lark
BM 485
BM 486
AH
BL
GS
FCH
GM
Go
1
32
34
35
81
82
83
85
89
102
107



SCALE 1:63360

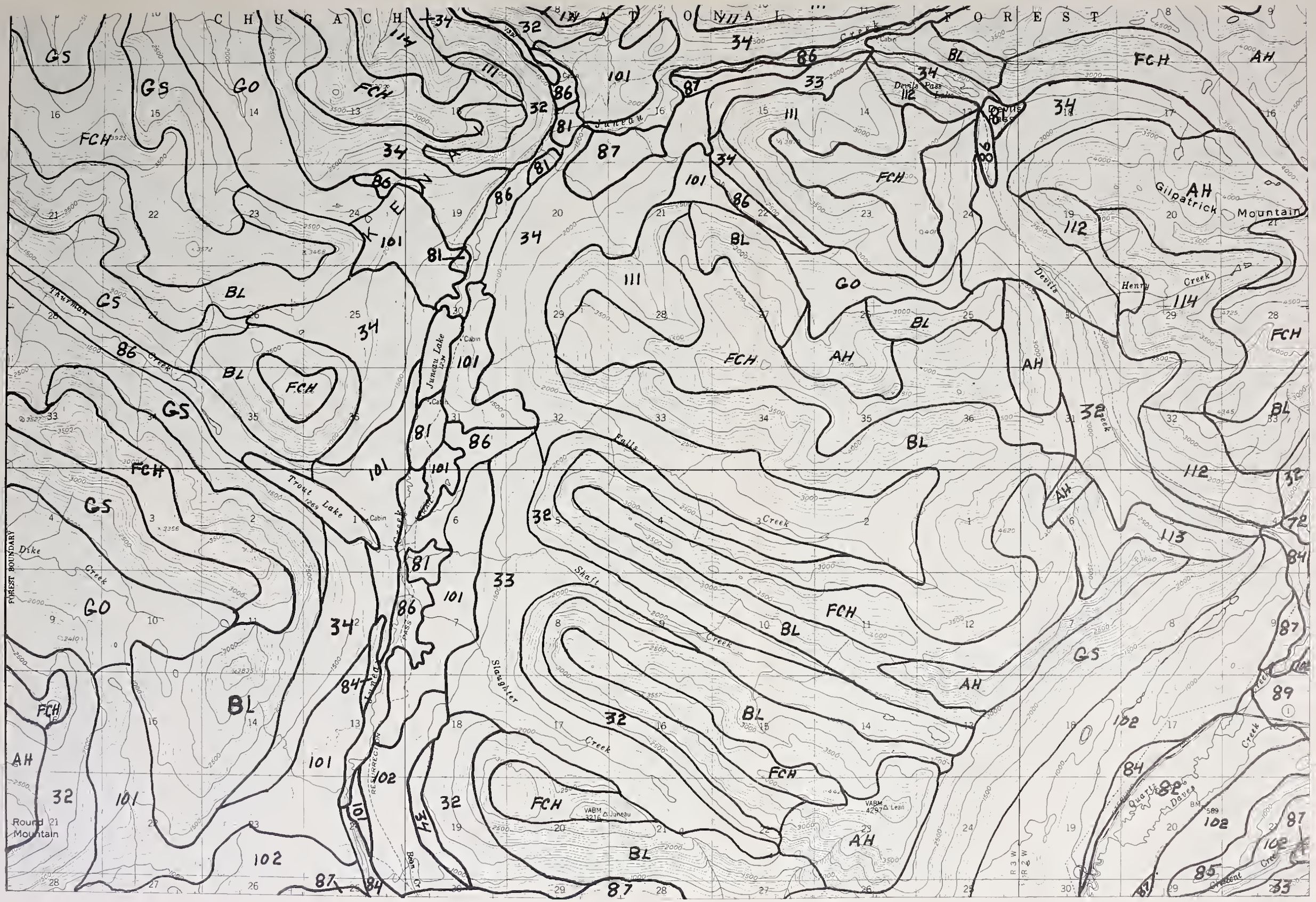
1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



SCALE 1 63360

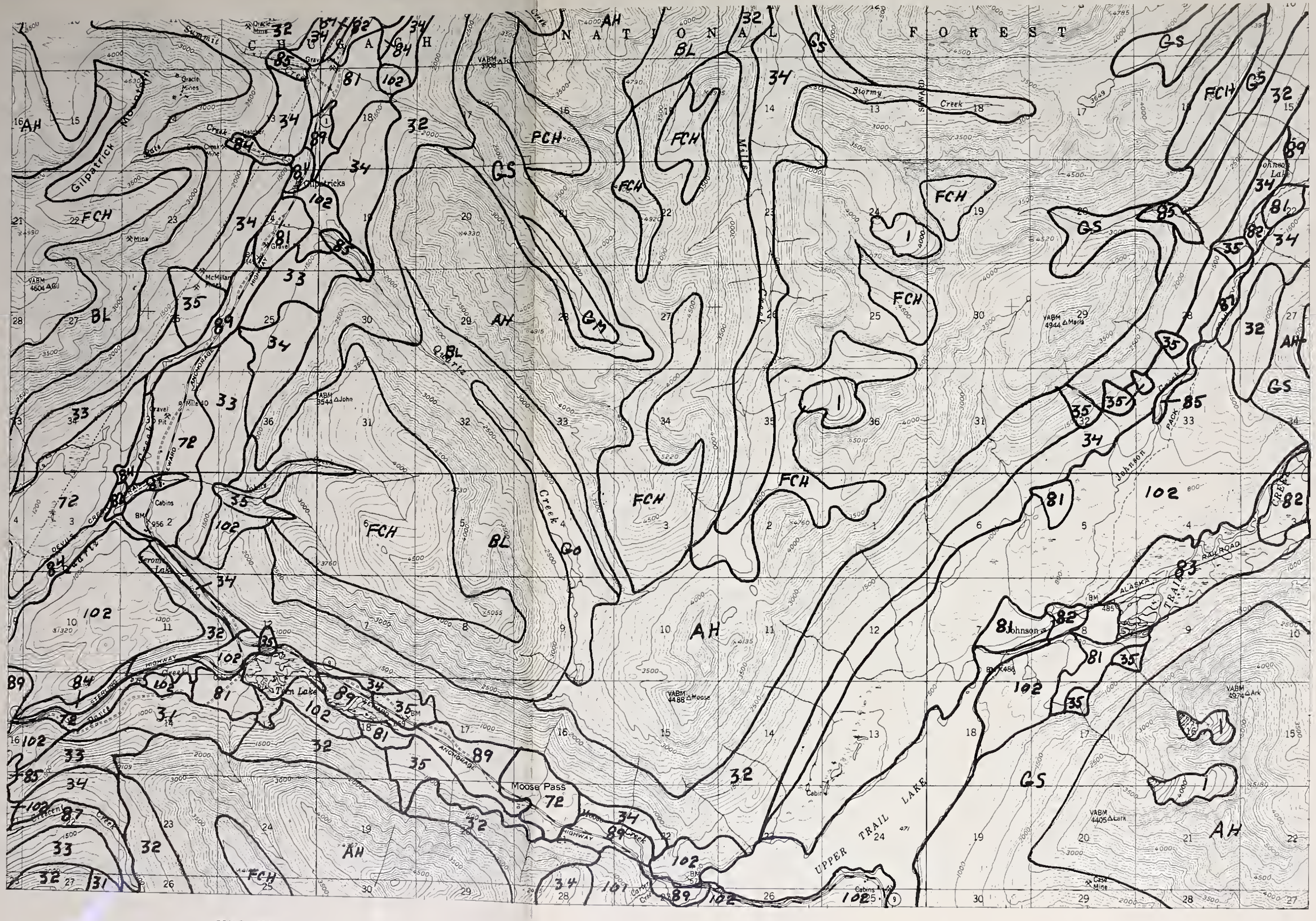
1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



SCALE 1:63360

4 MILES

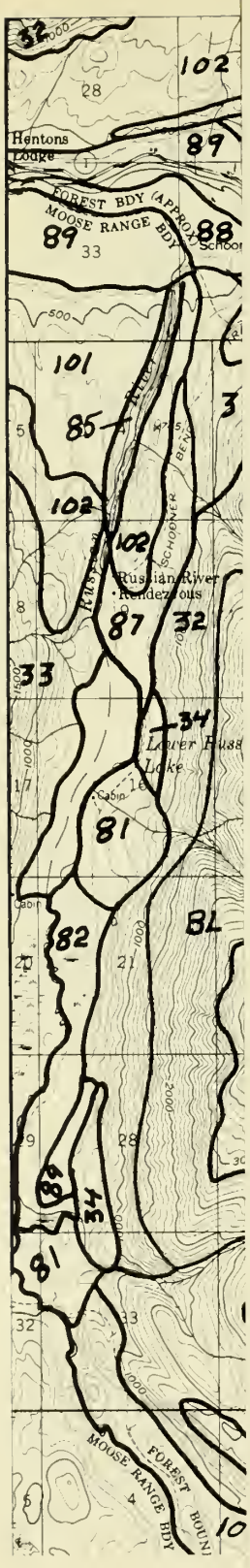
21000 FEET

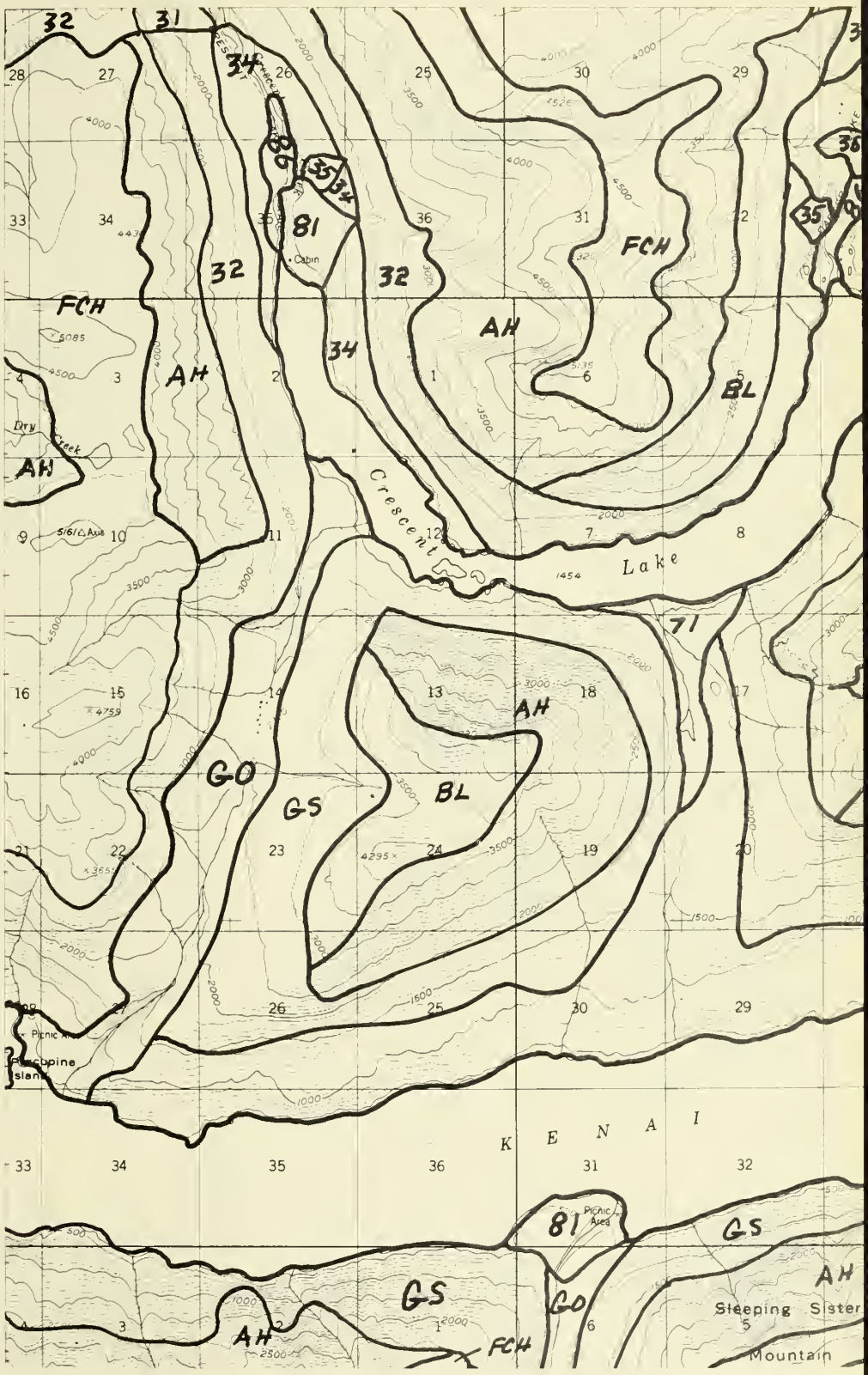
5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


COTTRELL GLACIER
TAYLOR GLACIER
GLACIER
FOREST
MONT
KINGS BAY
Crevasses
Crevasses
Crevasses
Crevasses
Crevasses
Crevasses
VABM Wagon
VABM Reply
VABM Moan
Yore
Ward
Jean
T 6 N
T 5 N





SCALE 1 63360

1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

SCALE 1:63360

1 0 1 2 3 4 MILES

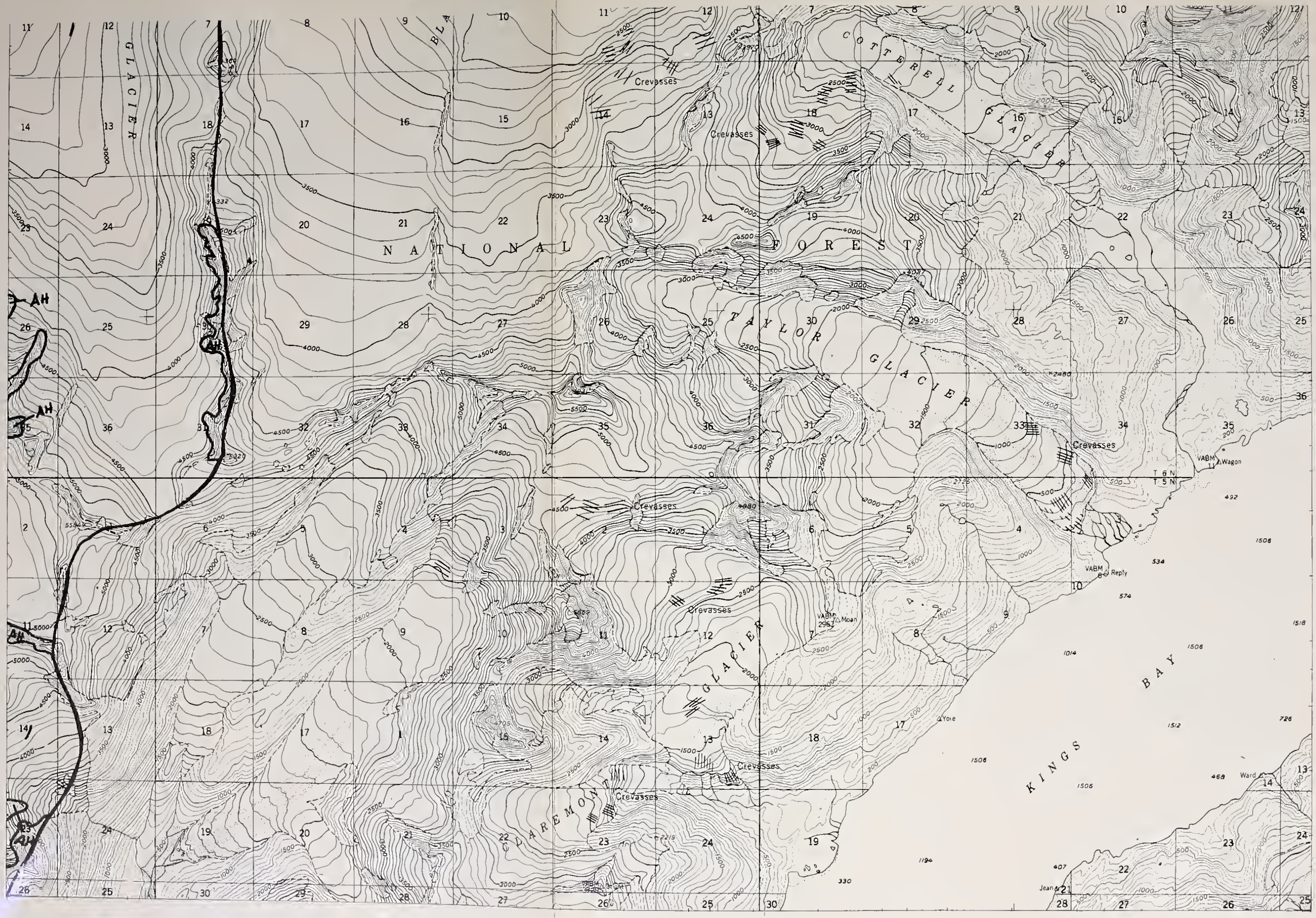
3000 0 3000 6000 9000 12000 15000 18000. 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL

Map Sheet 18



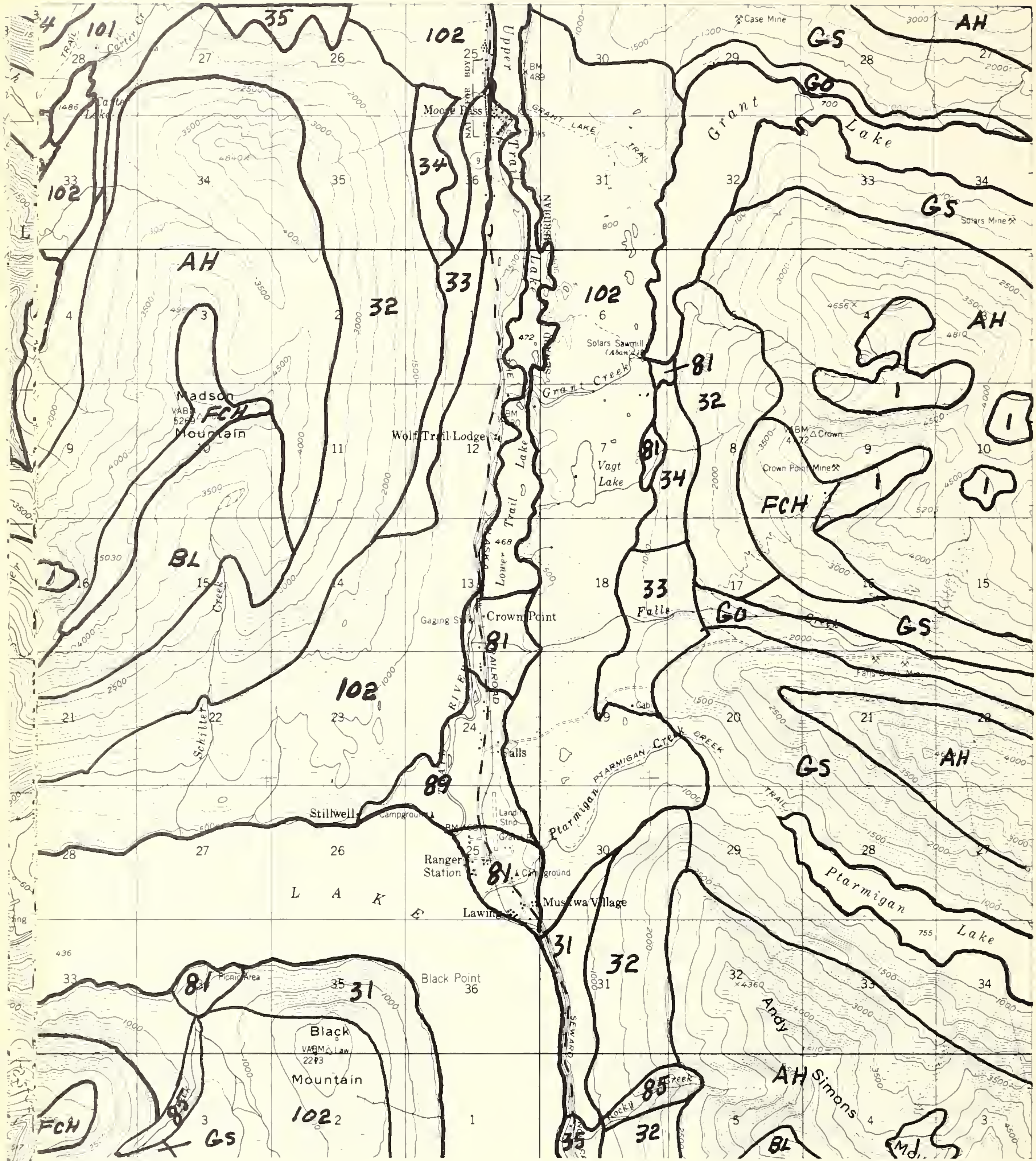
SCALE 1:63360

1 0 1 2 3 4 MILES

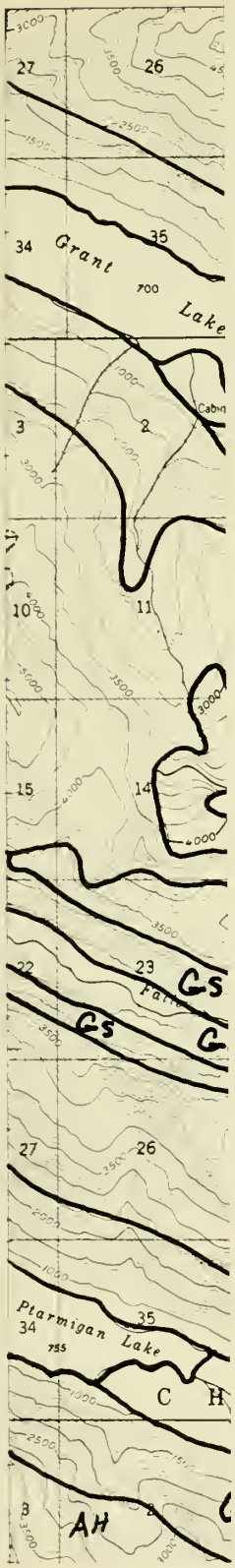
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL



101
35
102
AH
GS
GO
Case Mine
Carter Lake
Moose Pass
Upper Trail Lake
GRANT LAKE TRAIL
Grant Lake
34
33
32
Solars Mine
Solars Sawmill
Grant Creek
81
Madson Mountain
FCH
BL
Wolf Trail Lodge
Lower Trail Lake
Vagt Lake
Crown Point Mine
1
Crown Point
Gaging Sta.
Falls
Falls Creek Mine
ALASKA RAILROAD
Schilter Creek
Stillwell
Campground
Ptarmigan Creek
PTARMIGAN CREEK
89
Landing Strip
Ranger Station
Moose Pass
Lawing
Muskwa Village
LAKE
Ptarmigan Lake
Black Point
Picnic Area
31
Black Mountain
85
Rocky Creek
SEWARD
Andy Simons
Md



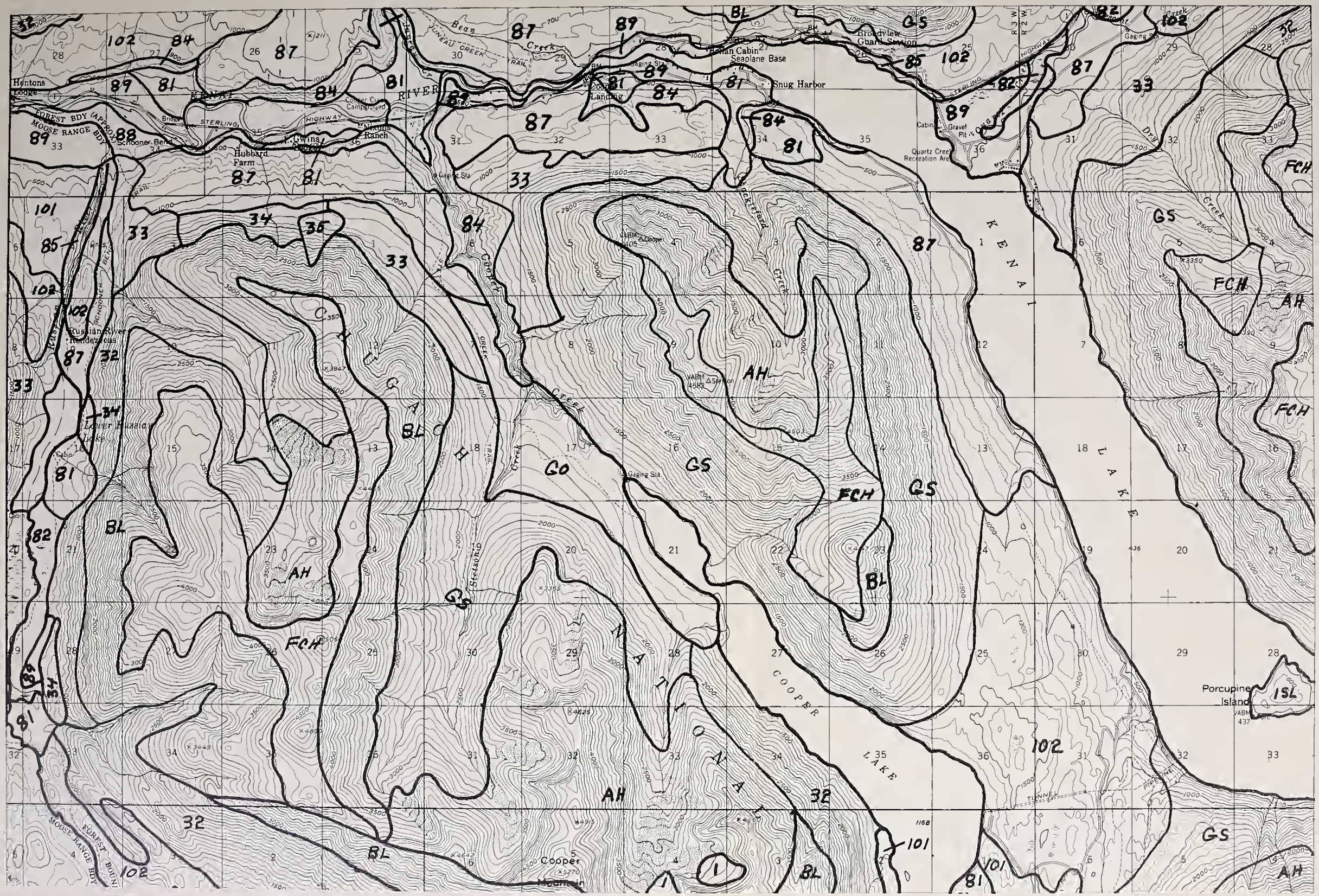
SCALE 1:63360

1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL



SCALE 1:63360

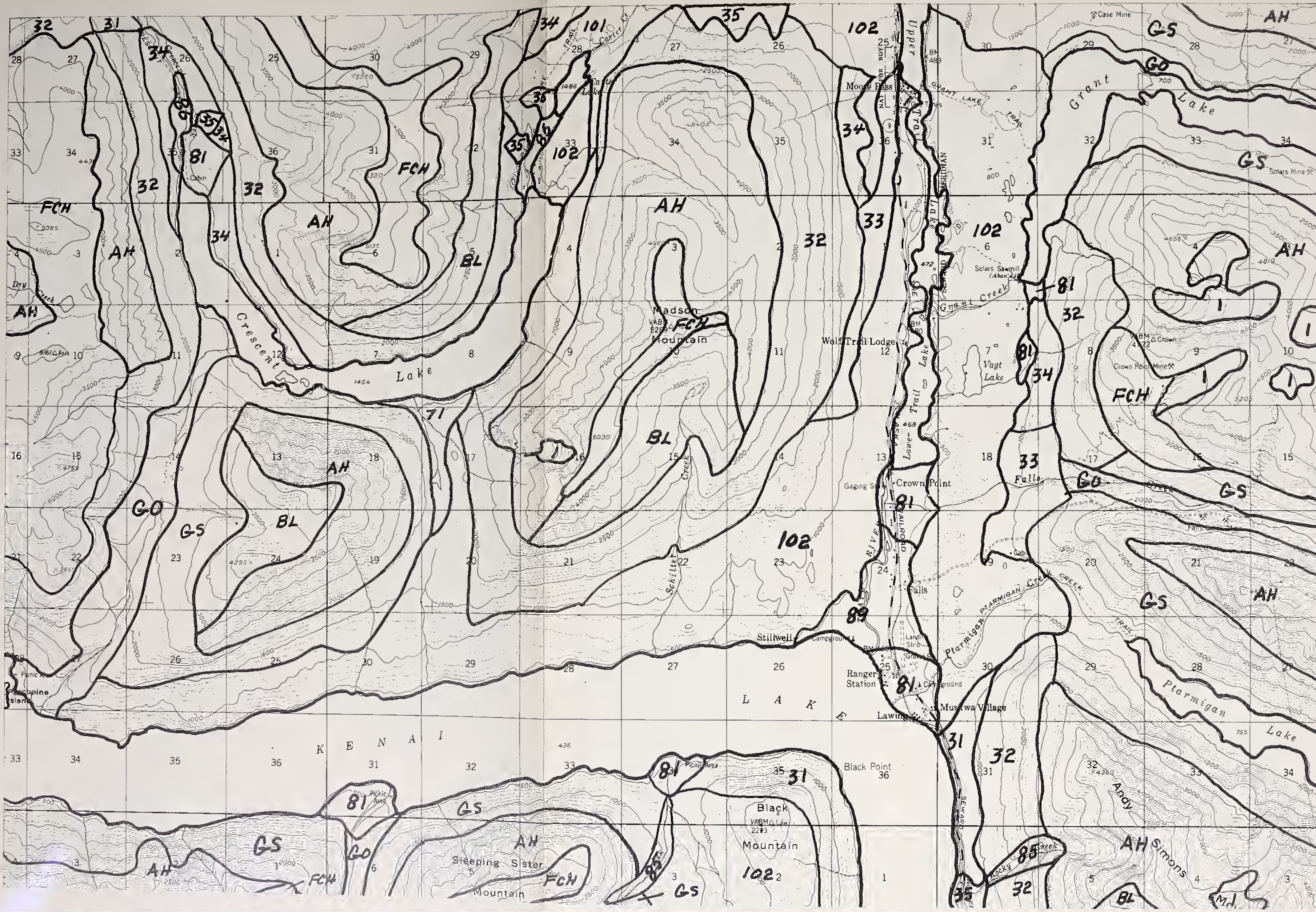
1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



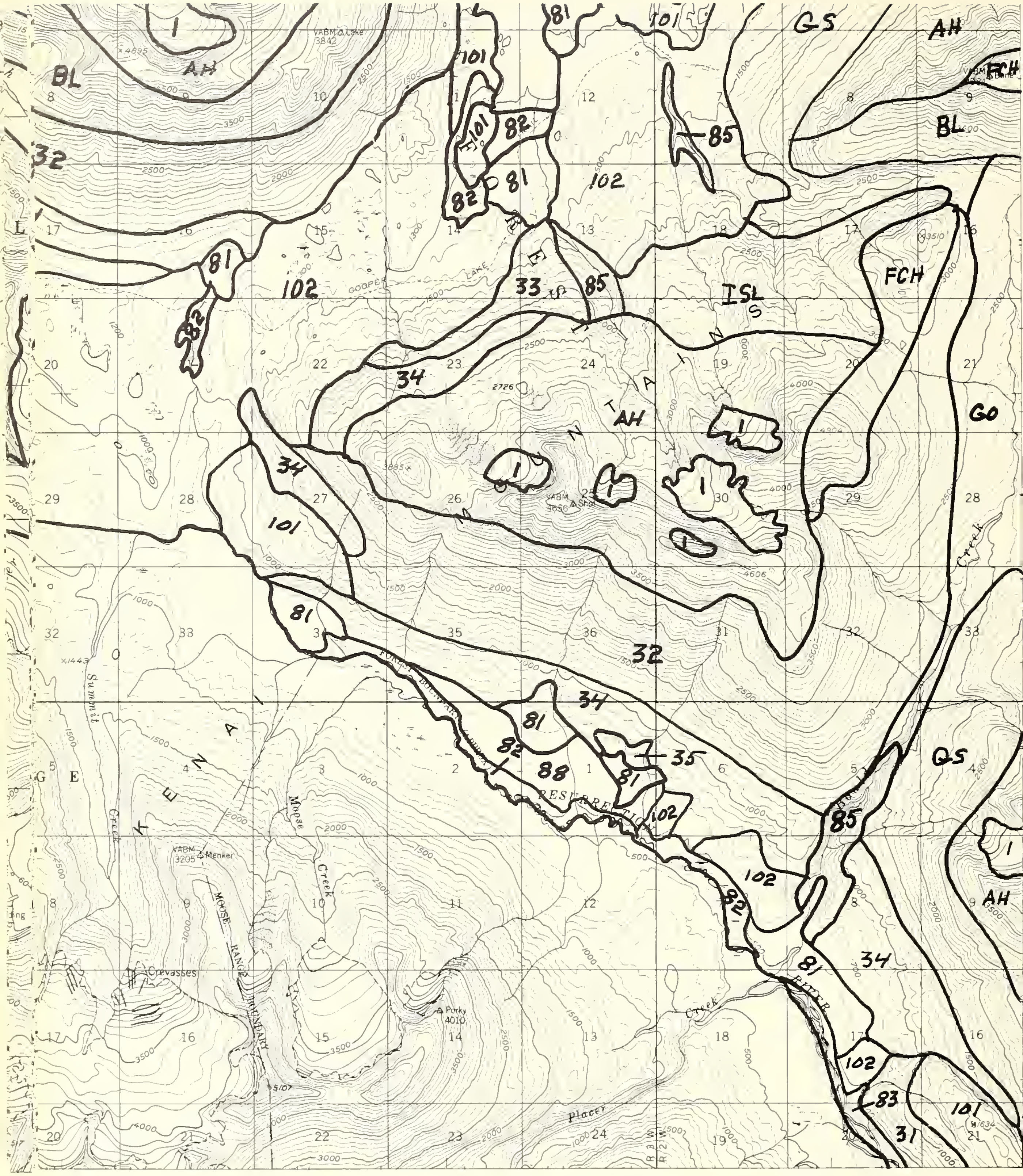
SCALE 1:63360

0 1 2 3 4 MILES

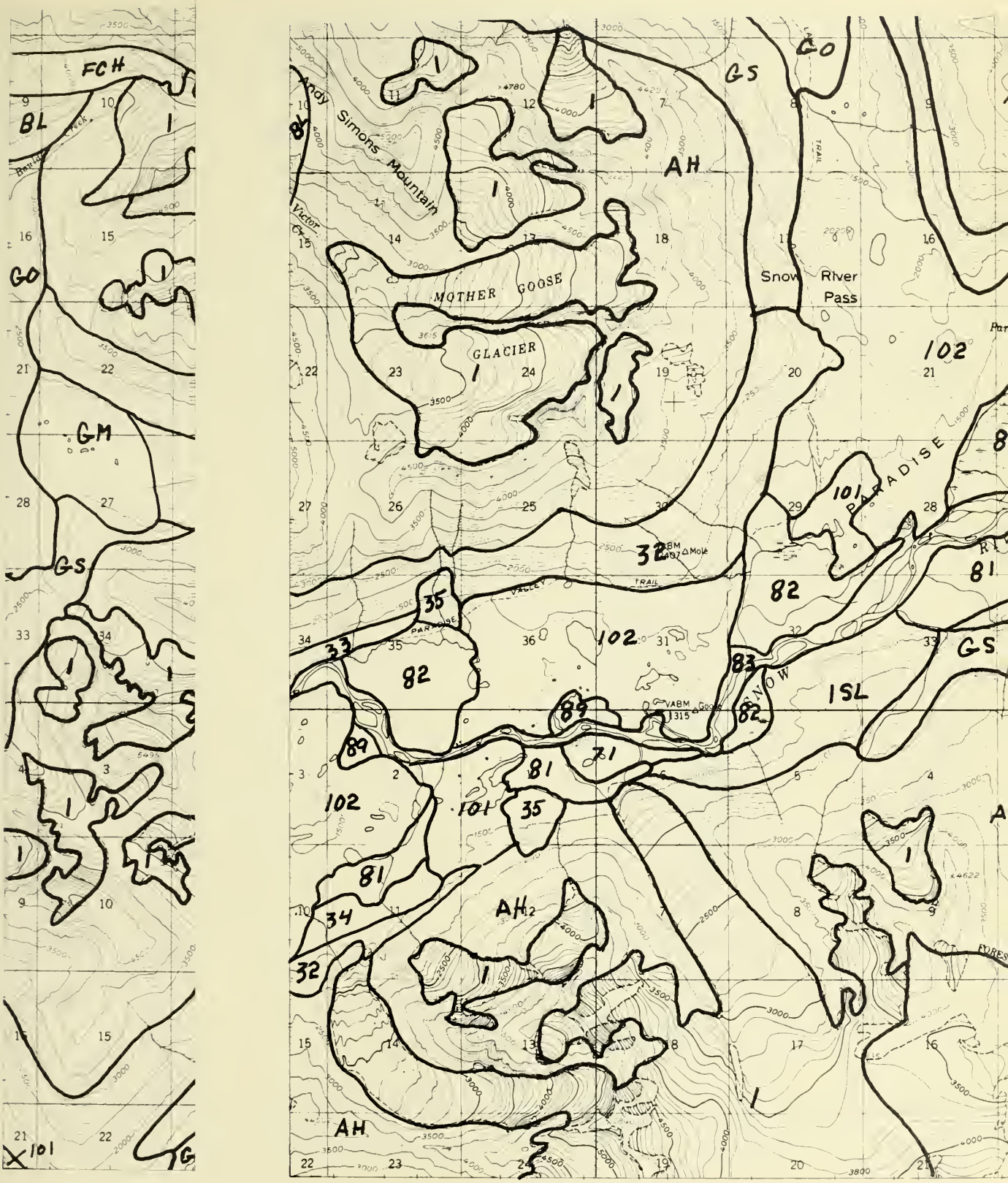
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL



BL
AH
32
GS
FCH
101
81
82
102
85
ISL
33
34
1
GO
QS
88
35
83
31
VABM Lake 3842
COOPER LAKE
VABM 4656 Shot
VABM 3205 Menker
Porky 4010
Crevasses
Summit Creek
Moose Creek
MOOSE RANGE BOUNDARY
RESURRECTION
RIVER
Placer
R 3 W
R 2 W



SCALE 1 63360

4 MILES

21000 FEET

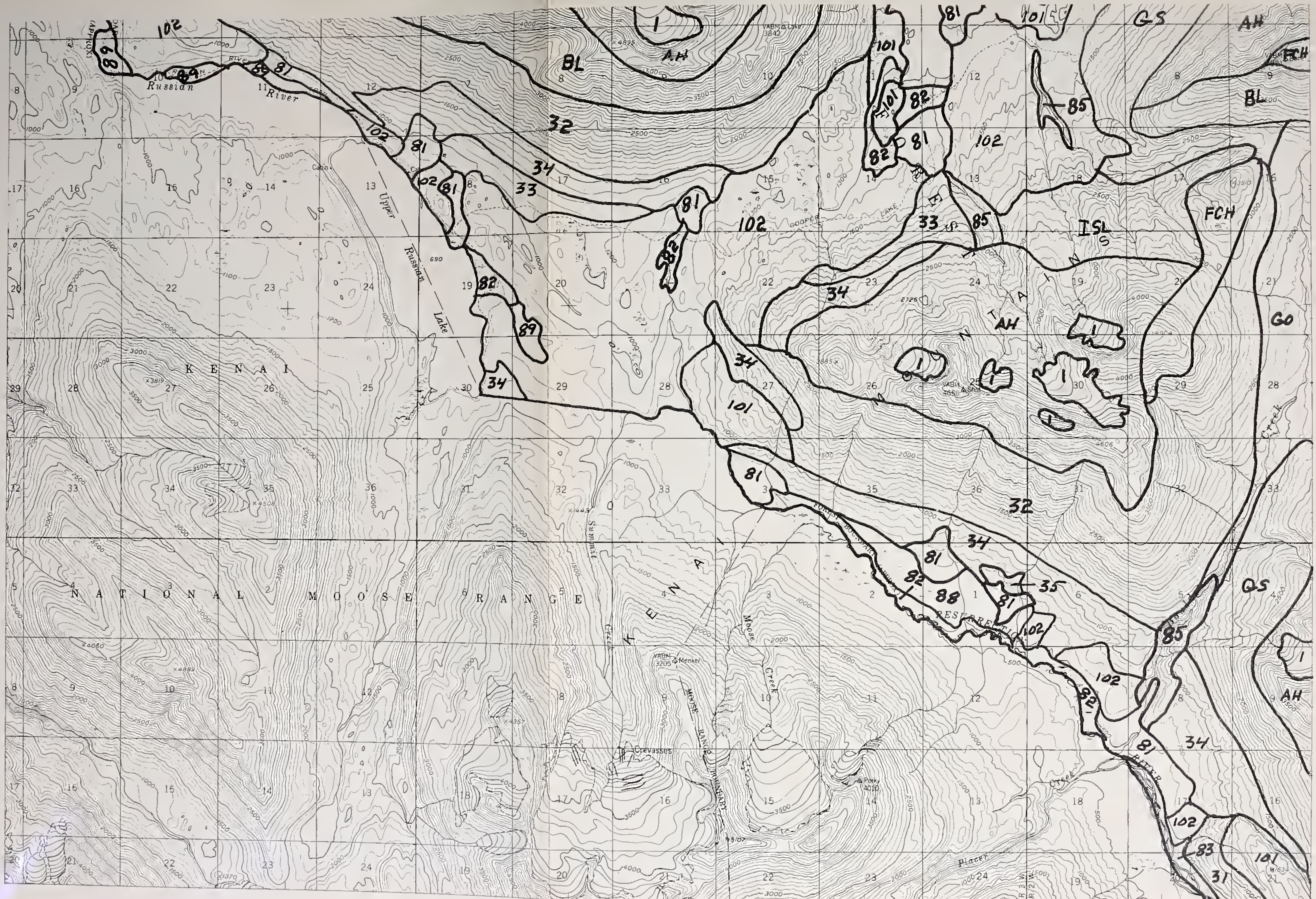
5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


Grant Lake
Ptarmigan Lake
Moose Creek
Cabins
Crevasses
Crevasses
Crevasses
Creek
FOREST BOUNDARY (APPROXIMATE)
CHUGACH NATIONAL FOREST
RIVER
AH
FCH
GS
GO
ISL
83
101
102
SCALE 1:63360
4 MILES
21000 FEET
5 KILOMETERS
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

Map Sheet 22



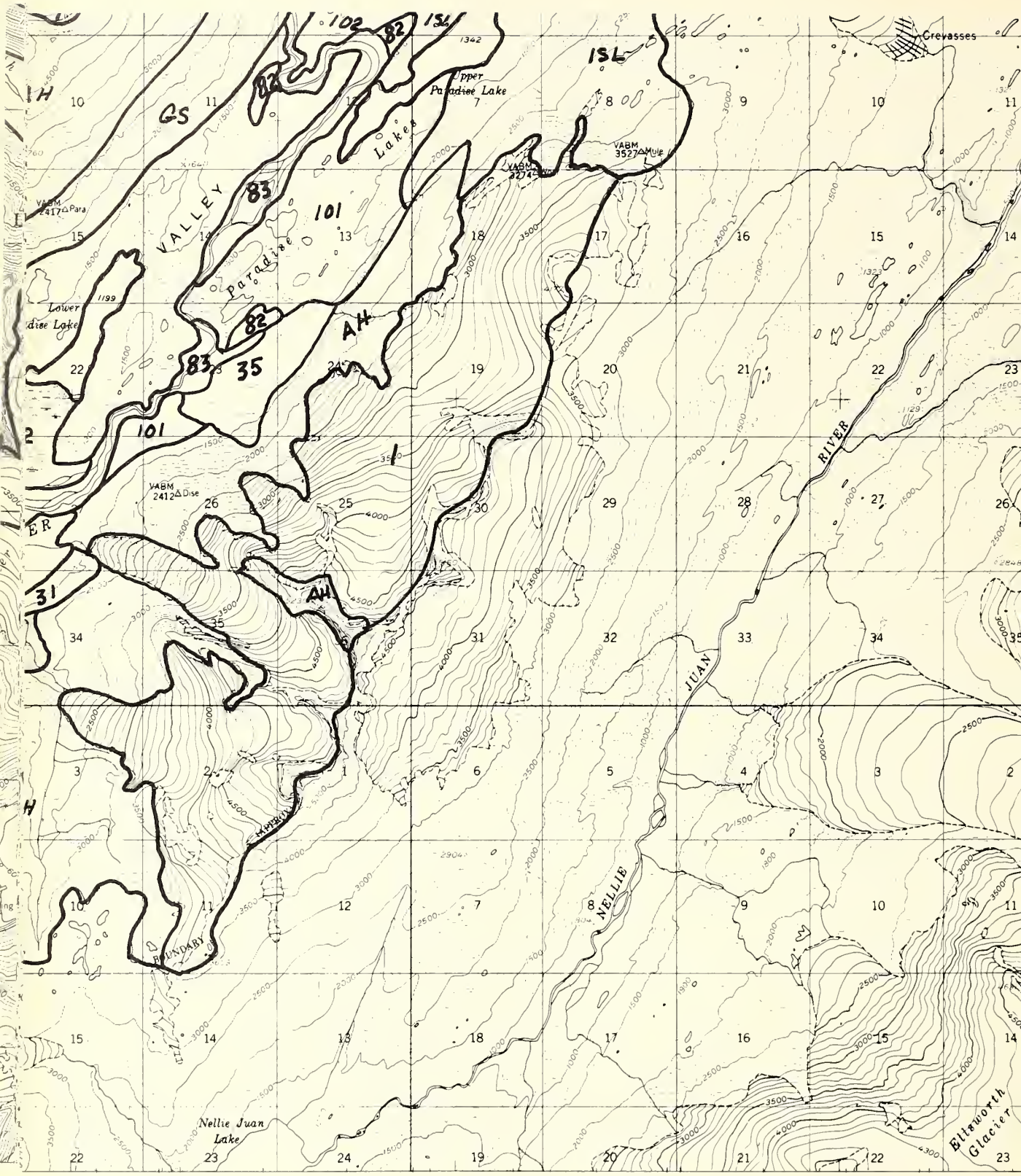
SCALE 1:63360

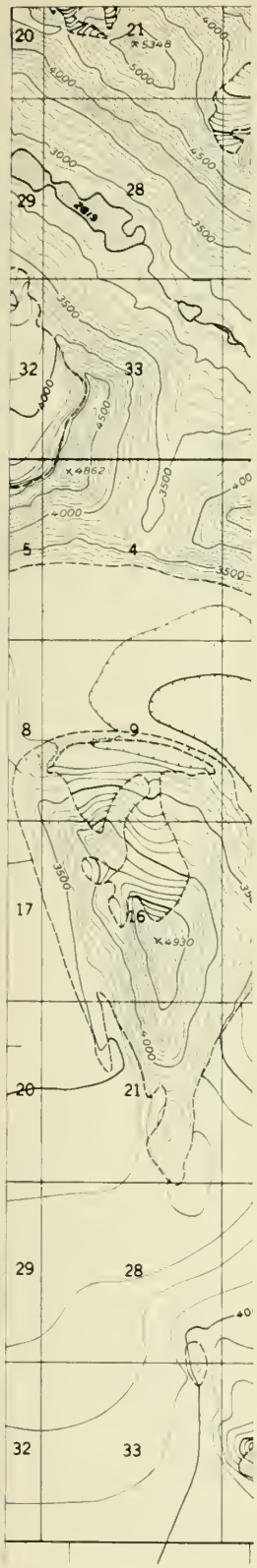
1 ½ 0 1 2 3 4 MILES

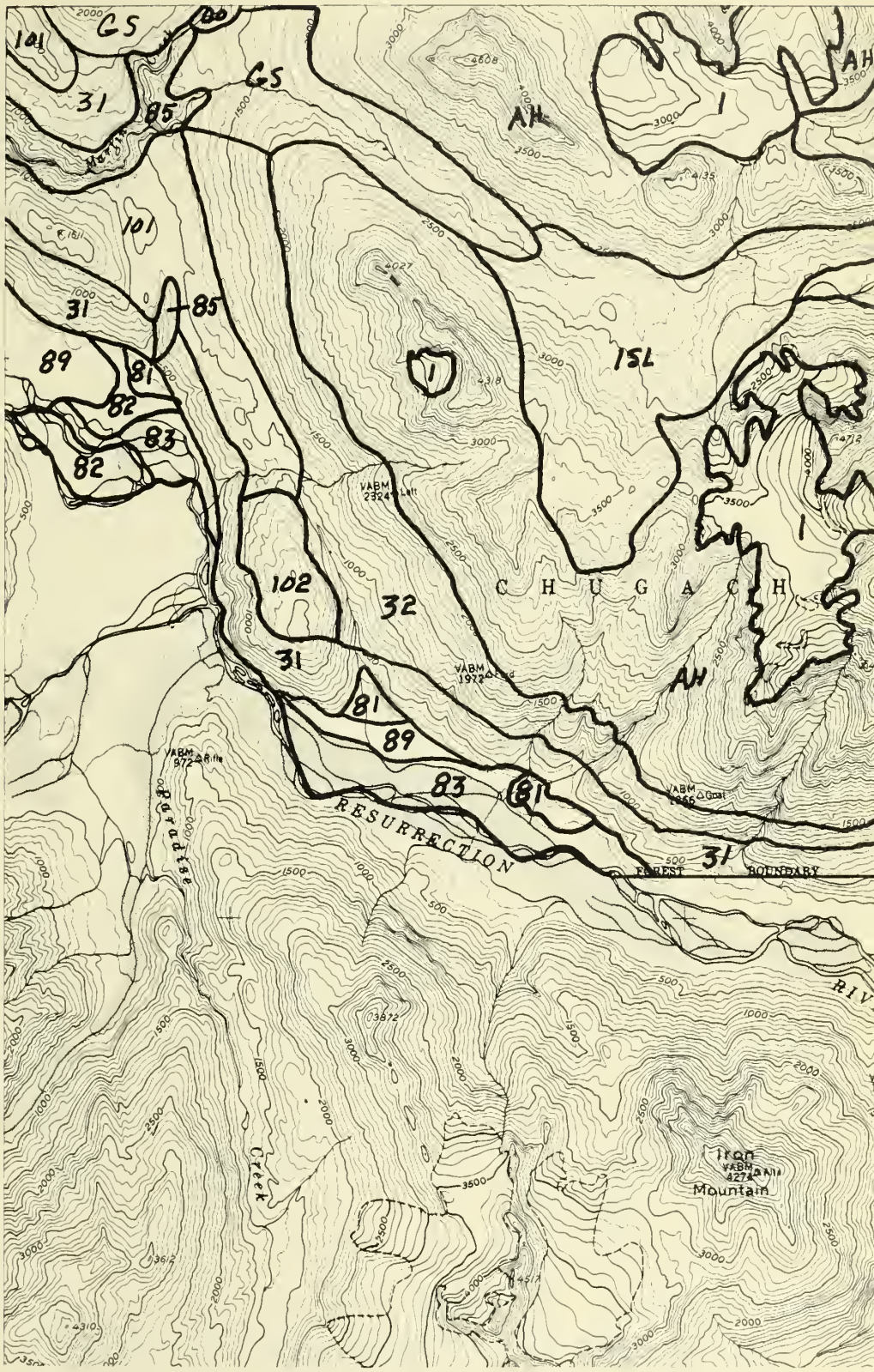
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL


Crevasses
Upper Paradise Lake
Lakes
VALLEY
Paradise
Lower Dise Lake
VABM 2417 Para
VABM 3527 Mule
VABM 2412 Dise
RIVER
JUAN
NELLIE
BUNDABY
Nellie Juan Lake
Ellsworth Glacier
GS
AH
102
82
154
83
101
35
31





SCALE 1 63360

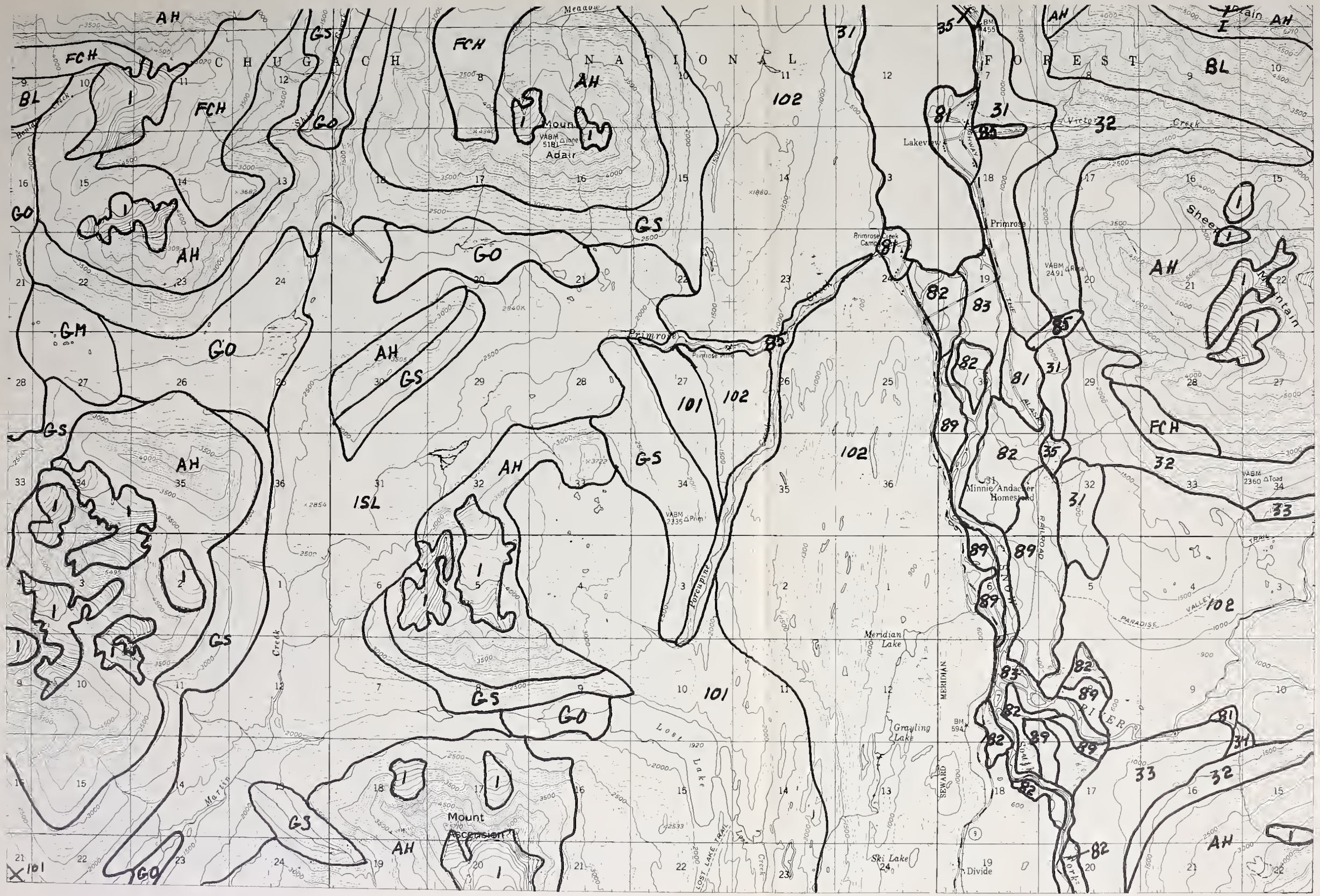
1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



SCALE 1:63360

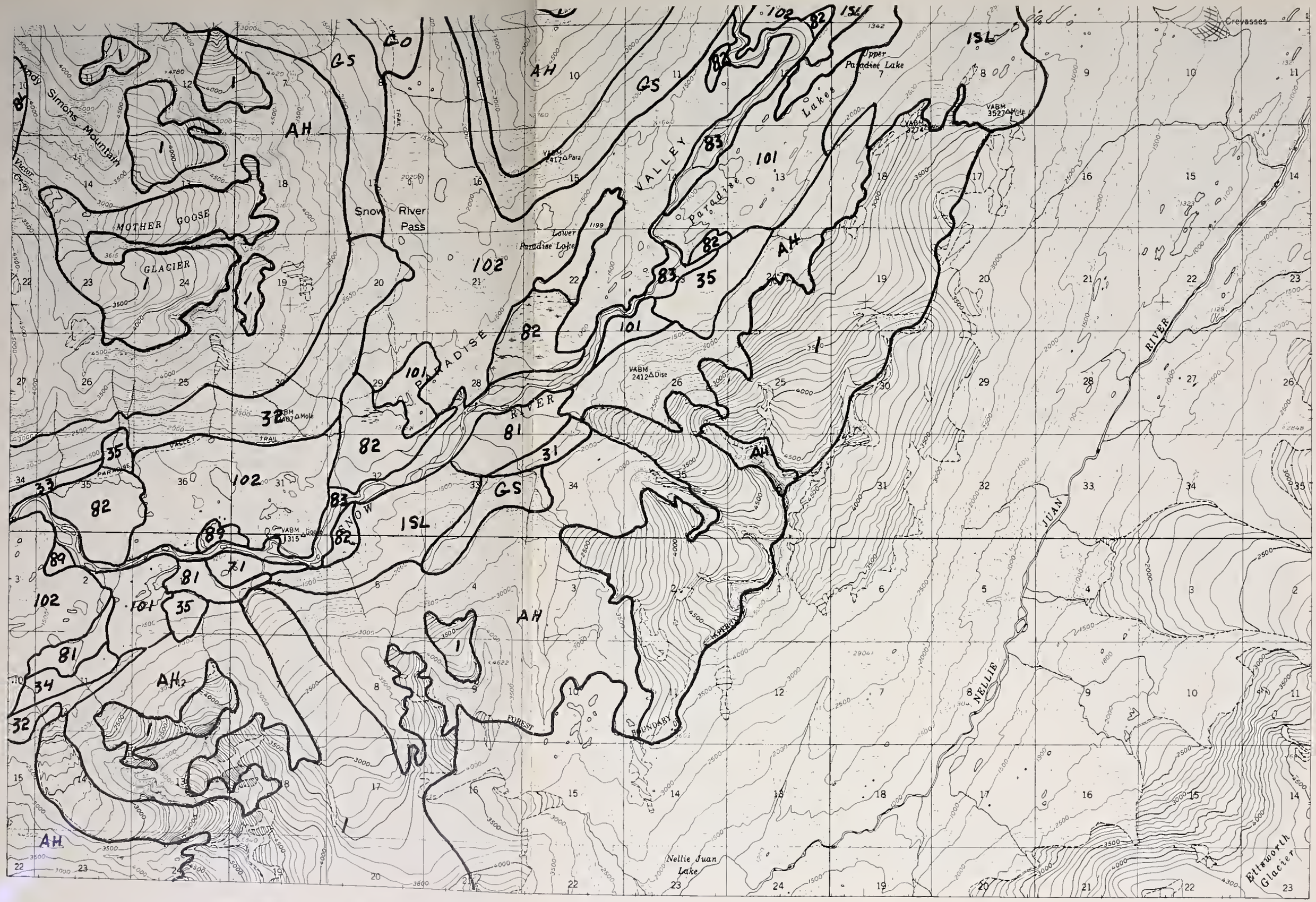
1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



SCALE 1:63360

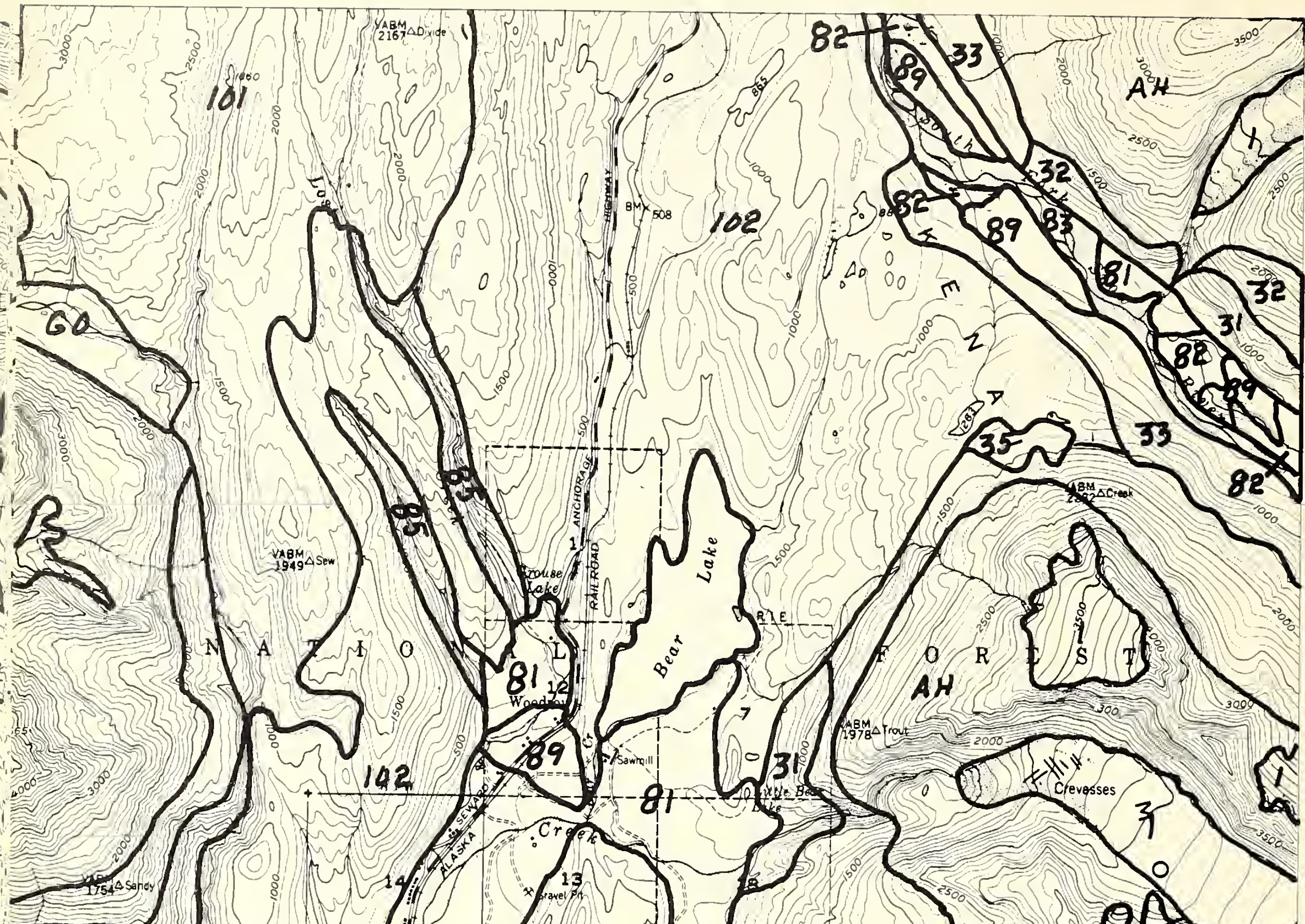
4 MILES

21000 FEET

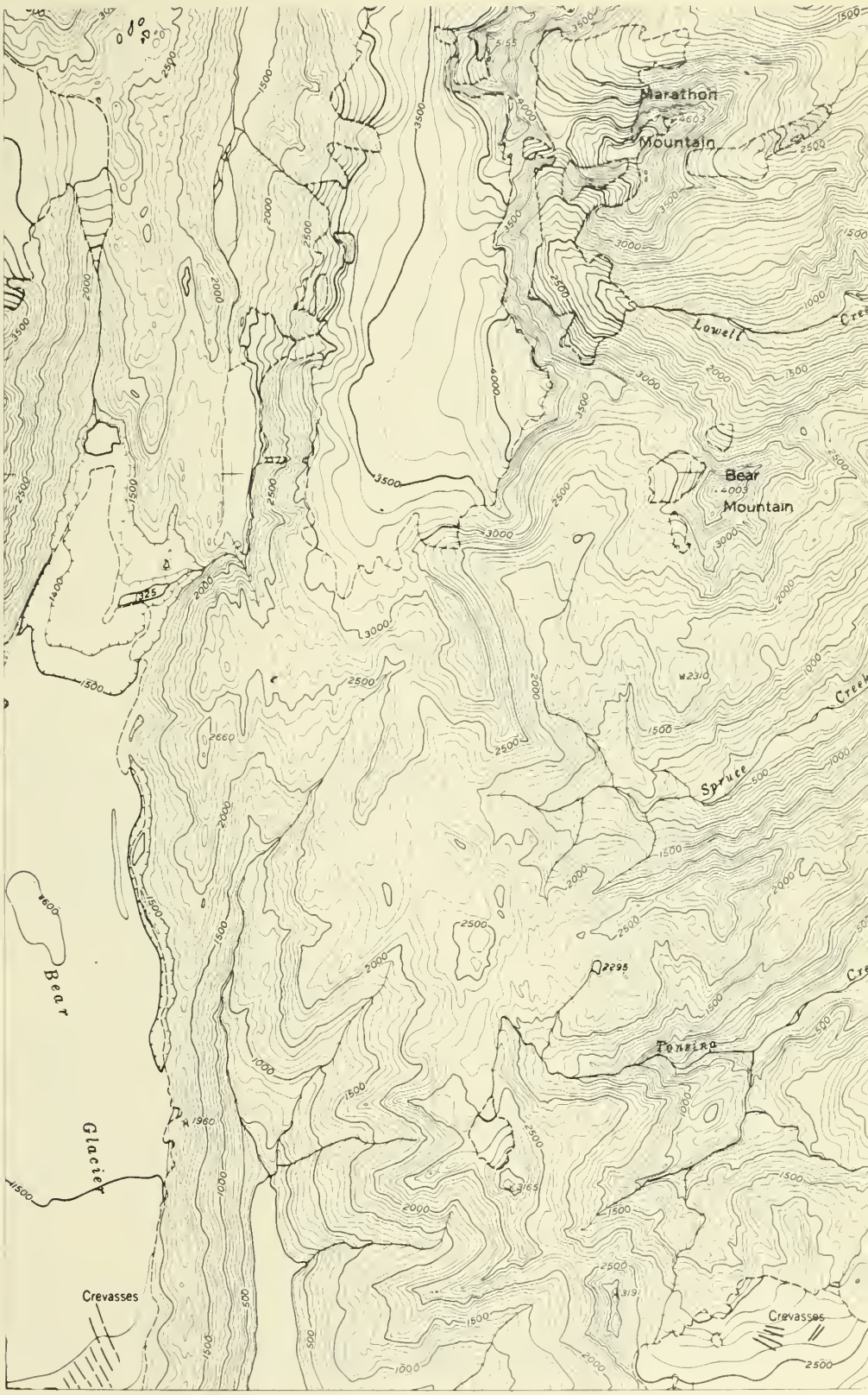
5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL



NATIONAL FOREST
KENAI
Bear Lake
Grouse Lake
Woodrow
Sawmill
Gravel Pit
Crevasses
Salmon Creek
ANCHORAGE RAILROAD
HIGHWAY
ALASKA SEWARD
SEWARD MERIDIAN
SEWARD BASE LINE
APPROXIMATE
Bayview School
Oil Tanks
Seward Airport
Bridges
VABM 2167 Divide
VABM 1949 Sew
VABM 1754 Sandy
VABM 1978 Trout
VABM 2266 Ward
Seward N Base VABM 46
101
102
GO
GS
AH
81
82
83
85
89
31
32
33
35



SCALE 1 63360

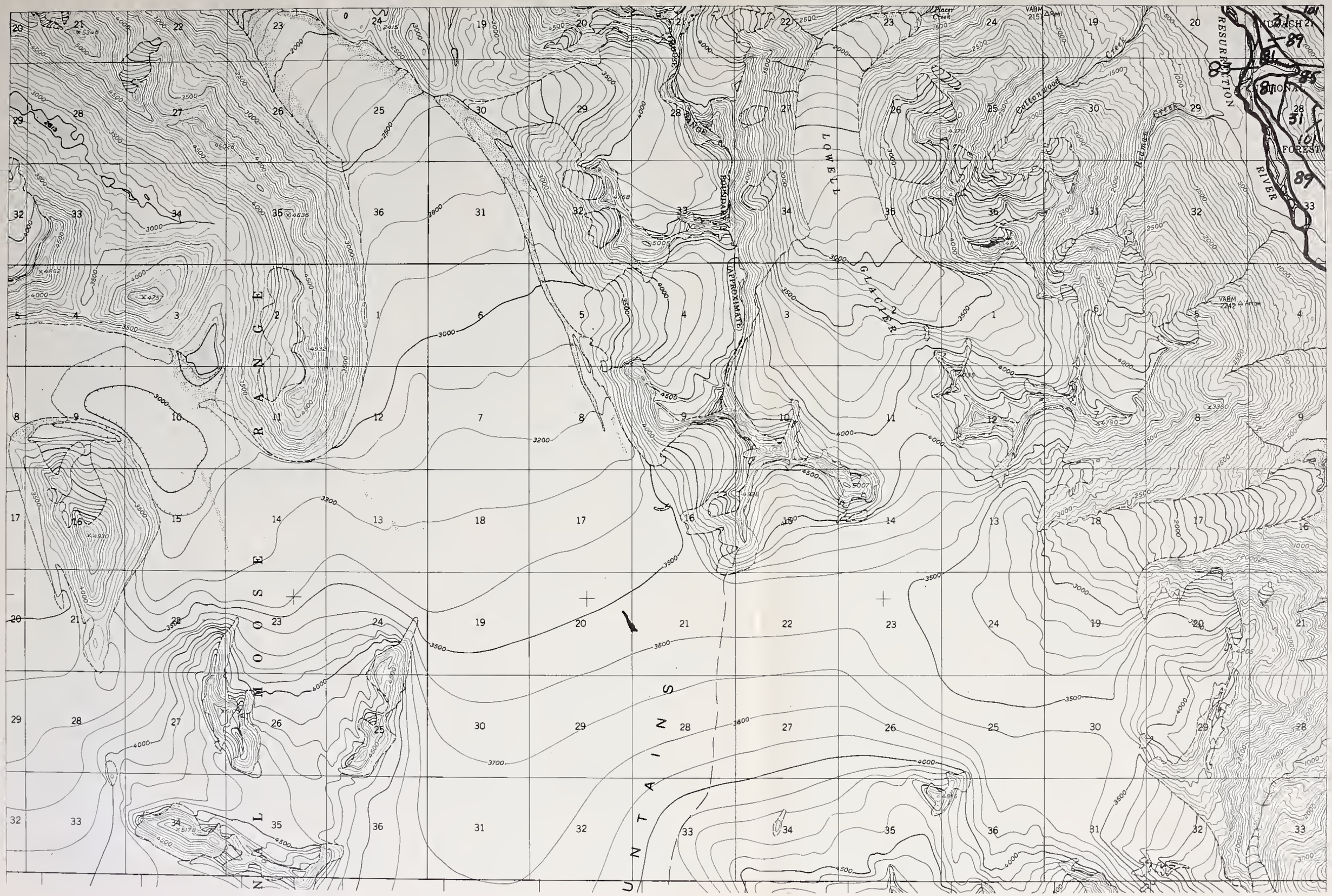
4 MILES

21000 FEET

5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


RANGE
TOWNSHIP
GLACIER
APPROXIMATE
RESURRECTION
RIVER
FOREST
Placer Creek
Cotton wood
Helmer Creek
VABM 2153
VABM 2242
SCALE 1:63360
4 MILES
21000 FEET
5 KILOMETERS
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

SCALE 1:63360

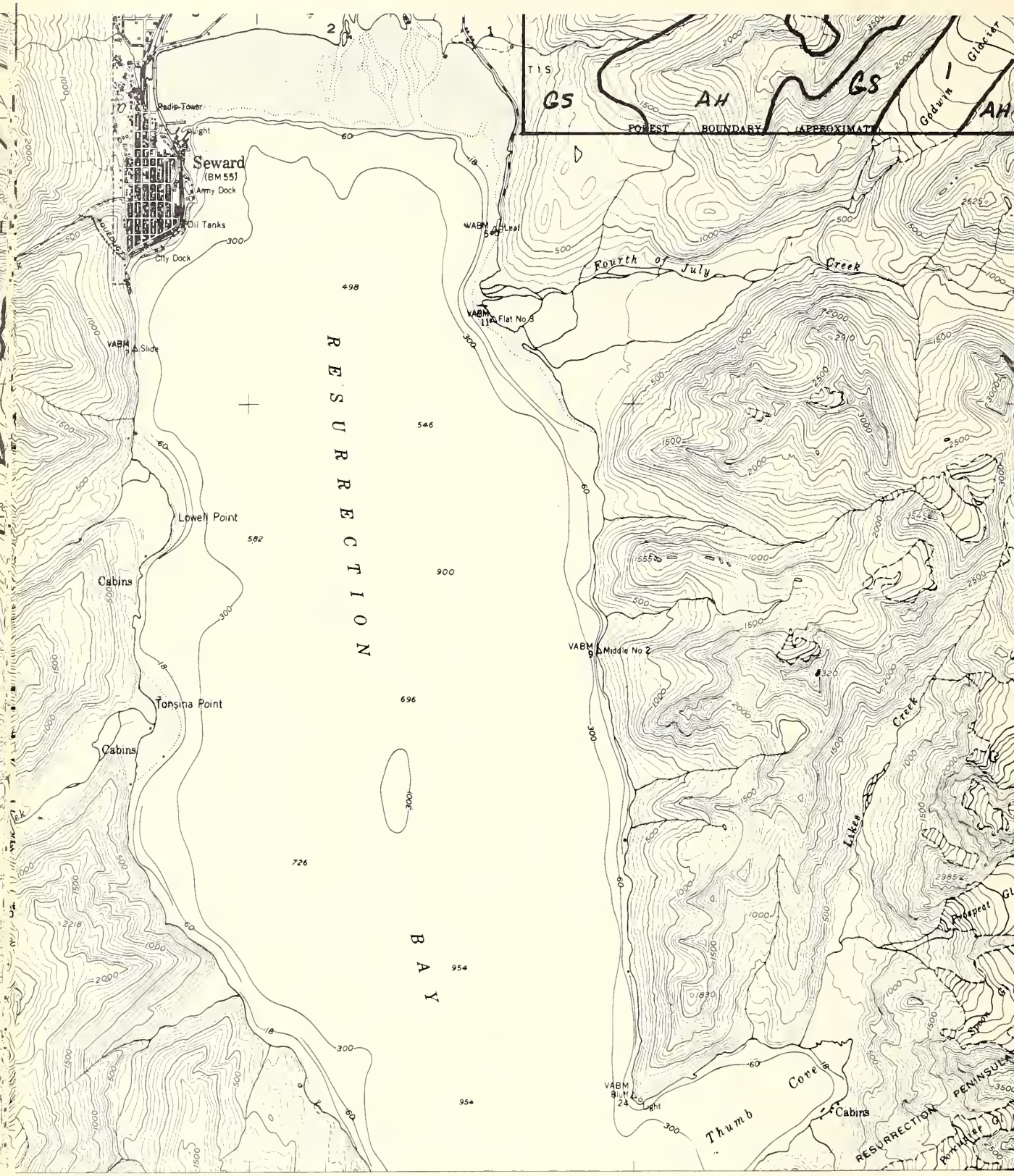
4 MILES

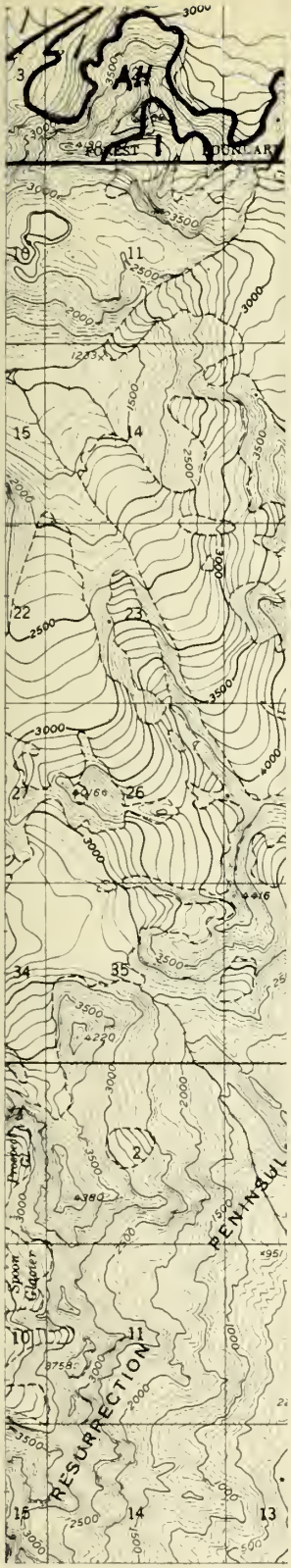
21000 FEET

5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


Seward
(BM 55)
Army Dock
Oil Tanks
City Dock
Radio Tower
Light
VABM Slide
VABM Leaf
VABM Flat No. 8
VABM Middle No. 2
VABM Thumb
Lowell Point
Cabins
Tonsina Point
Cabins
RESURRECTION
BAY
Fourth of July
Creek
Likeo
Creek
Cove
Cabins
RESURRECTION
PENINSULA
T 1 S
Gs
AH
Gs
Godwin
Glacier
FOREST BOUNDARY (APPROXIMATE)


AH
FOREST
BOUNDARY
RESURRECTION
PENINSULA
Spoon Glacier

SCALE 1:63360

1 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL

SCALE 1:63360

1 0 1 2 3 4 MILES

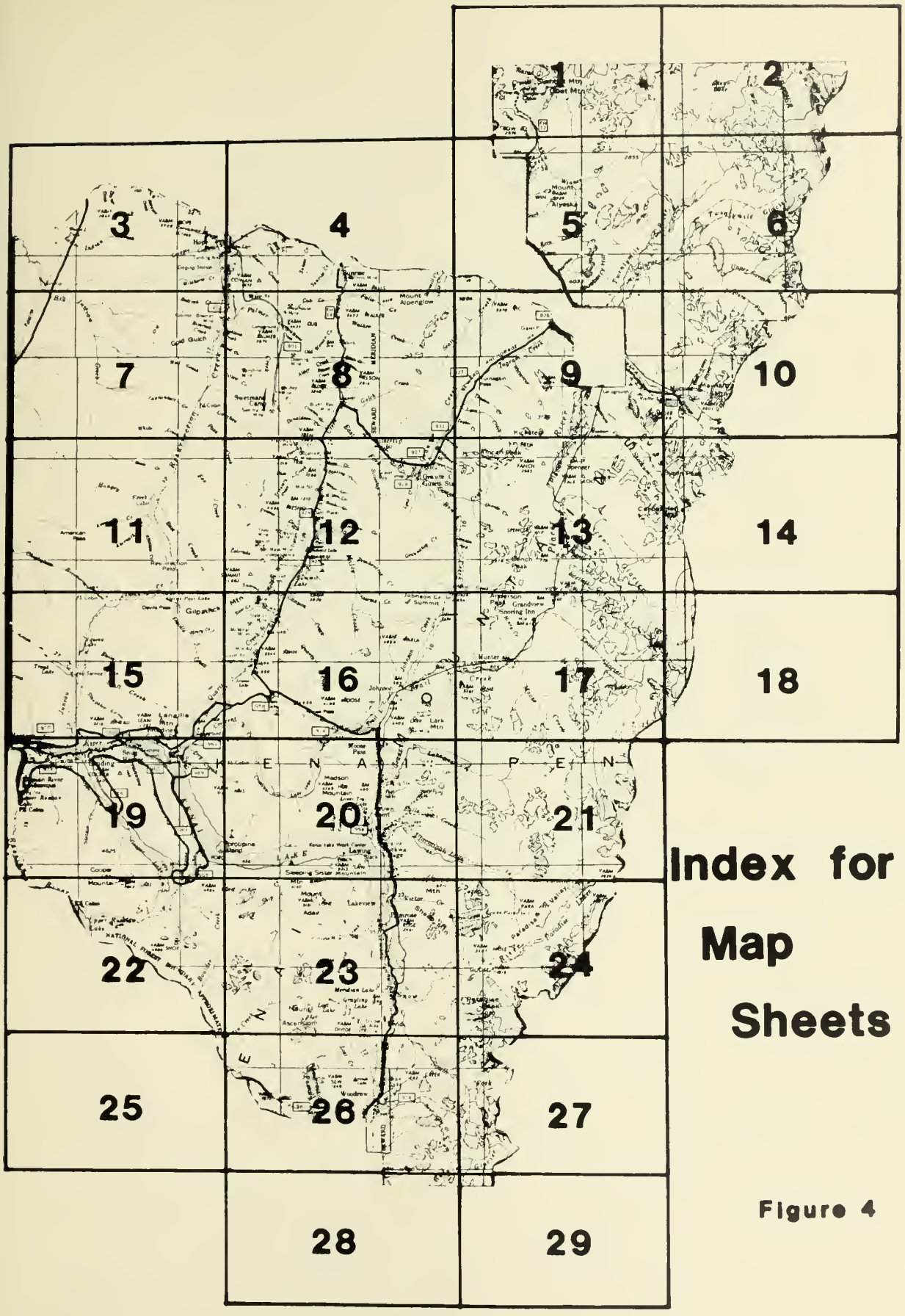
3000 0 3000 6000 9000 12000 15000 18000. 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL


(APPROXIMATE)
Crevasses
Crevasses
PENINSULA
DAY HARBOR
Bowan Anchorage
Bowen
RESURRECTION
Travis Bay
SCALE 1:63360
1 0 1 2 3 4 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
1 5 0 1 2 3 4 5 KILOMETERS
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL



Index for Map Sheets

Figure 4

MAP LEGEND

Map Symbol	Mapping Unit
AH	Alpine Highland Landtype Association
FCH	Frost Churned Highland Landtype Association
GS	Glacial Sideslope Landtype Association
31	Upper Sideslope - Forested Landtype
32	Upper Sideslope - Non-forested Landtype
33	Concave Lower Sideslope - Forested Landtype
34	Concave Lower Sideslope - Non-forested Landtype
35	Scree Fan Landtype
I	Ice and Snow Landtype Association
GM	Glacial Moraine Landtype Association
71	Low Relief Moraine with Outwash Plain Landtype
72	High Relief Moraine Landtype
GO	Glacial Outwash Landtype Association
81	Alluvial Fan Landtype
82	Low-lying Flood Plain Landtype
83	Unvegetated Stream Channel Landtype
84	River Cut Sideslope - Alluvium and Till Landtype
85	River Cut Sideslope - Bedrock Landtype
86	High Elevation Valley Train Landtype
87	Alluvial and Till Bench Landtype
88	Alluvial Terrace Landtype
89	Outwash Plain - Forested Landtype
TM	Tidal Marsh Landtype Association
ISL	Ice Scoured Land Landtype Association
101	Ice Scoured Land - Non-forested Landtype
102	Ice Scoured Land - Forested Landtype
BL	Breakland Landtype Association
111	Early Stage Breakland Landtype
112	Mid-stage Breakland Landtype
113	Late Stage Breakland Landtype
114	Headlands Landtype

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